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NIRA Section 7a and Collective Bargaining

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Editor, American Machinist

¶ Now that collective bargaining is a right guaranteed by a national law it is no longer the sole concern of altruistic employers and labor liberals—all of industry must be prepared to employ it. Successful employee representation plans have been operating for years, new ones are springing up like mushrooms, and labor unions are growing faster than ever before. In this situation experience is invaluable to those who have to do the bargaining and organize the necessary machinery. The marshaling of such experience is our purpose here.

SINCE most of the excitement and a large part of the arguments that have been generated by the National Industrial Recovery Act center around Section 7a of the Act, it may be as well to start this discussion by quoting the general labor provisions that appear in all NRA codes, because of the requirements of Section 7a. These provisions read as follows: "(1)—That employees have the right to organize and bargain collectively through representatives of their own choosing, and shall be free from the interference, restraint, or coercion of employers of labor, or their agents, in the designation of such representatives or in self organizations or in other concerted activities for the purpose of collective bargaining or other mutual aid or protection; (2) that no employee and no one seeking employment shall be required as a condition of employment to join any company union, or to refrain from joining, organizing, or assisting a labor organization of his own choosing, and (3) that employers shall comply with the maximum hours of labor, minimum rates of pay and other conditions of employment, approved or prescribed by the President."

Leaders of organized labor who had been forced to sit by and watch their numbers cut in half by the hardships of the depression hailed this section of NIRA as a mandate to organize all of American industry. Many of them failed to realize that the labor provisions of NIRA represented a new point of view, the point of view of the President's New Deal, and they started in along the lines of old-fashioned craft union racketeering which had placed labor agitators of the past in a most unpopular position in the public eye. At ane stage of the proceedings last year, organizers of this type had so far exceeded the bounds of common sense and the legal limits of the law that they almost succeeded in generating a public reaction that would have forced congress to rescind or amend drastically Section 7a.

On the other hand, certain industrial leaders, little better equipped mentally than the type of labor leader just mentioned, set out to head off the advances of organized labor by establishing company unions that had no other purpose than to forestall unionization of their plants and were so manifestly insincere that they fooled nobody. Remarkable as were the gains of the labor unions, the enlistment of men in company unions and employee representation plans was even

more astounding. A report just issued by the Committee on Industrial Relations of the National Metal Trades Association, gives interesting statistics of the sudden jump in activity in introducing employee representation in the metal trades.

A questionnaire sent out by this committee to the members of the National Metal Trades Association brought forth the information that in twelve member companies employee representation plans have been in effect more than ten years. In four companies plans have been going between five and ten years and in three between one and five years. These 19 plans affect some 20,000 employees. Contrast this very slow development with the 75 companies where such plans have been started since the enactment of NIRA. These 75 plans affect 198,000 employees. The report goes on to say that this ratio of development is closely in line with the ratio for other industries as reported by the National Industrial Conference Board.

Another rather remarkable contrast between the situation existing before the passing of NIRA and the present lies in the number of small plants where employee representation plans of various sorts are in effect. Thirty-three of the 94 reporting plants employ less than 200 men. The great bulk of the employees affected is in the few plants employing 5,000 men and over, but the fact that so many of the smaller plants are finding employee representation plans workable is an interesting development. Another bit of statistical information that may be worth mentioning here is that 13 of the 94 reporting metal trade plants are in the automotive industry and that they employ more than 150,000 men, or 71.6 per cent of the total affected. The employee representation plans of Chrysler and General Motors account for a large proportion of this group.

Three Types of Plans

ALTHOUGH employee representation has made relatively little headway since it first made its appearance in this country just prior to 1900, several types of plans have been developed and have been in operation long enough so that we should be able to profit by the experiences of those who have operated under them. Of the three general types, the most elaborate one, which was based on the organization of the United States Government, has turned out to be too complicated to be workable and has practically disappeared. Under the terms of this plan the employees elected a house of representatives, the foreman and minor executives elected a senate, and the major executives constituted the cabinet. These plans were so cumbersome, time consuming and expensive that most of them failed to survive.

Both of the other two types of employee representation plans have been subject to fewer disadvantages than the industrial democracy plan, and are to be found in many progressive companies today. Each has its respective advantages and disadvantages. The first of these two plans is the employee committee plan where the employees elect a representative committee which meets independently of the management, formulates its suggestions or demands, and then negotiates them with the management. A plan of this type is more likely to be employed where the employees or some important part of them are organized in a national union. It has the advantage, of course, that the members of the committee can discuss questions freely among themselves, free of the handicap of reserve unavoidable when members of the management are present. On the other hand, many minor difficulties become magnified through misunderstandings when they are discussed in an employee committee, whereas they might be explained away or settled very quickly if the discussion included a member of the management who could explain what was not clear.

Lack of Confidence

GENERALLY speaking, an employee committee is more likely to have the confidence of the rank and file of the employees, although there is an amusing incident to show that this confidence is not always so easy to win. The incident occurred in a plant of moderate size which had elected an employee committee of three to deal with the president. Somewhat to the president's surprise, the committee was accompanied by some 60 other employees when it came for its first meeting; the explanation was that the 60 men were there to keep an eye on the committee, and make sure it functioned as it was expected to do.

The third type of employee representation plan and the one that seems to have had the most general success is the joint committee or works council type. Under this plan elected representatives of the employees meet with one or more representatives of the management to discuss differences and to settle grievances as they arise. Properly organized and conducted, such a plan can go very far to bring together the divergent interests of employers and employees and to educate both sides as to the problems and ambitions of the other. A works council can settle the very great majority of disputed points without referring them to any higher authority. On the other hand, it is absolutely essential that machinery for appeal and arbitration be available to handle such cases as are beyond the ability of the counselors to settle. The very fact that appeal is provided for results in a lulling of suspicion and a far greater likelihood that differences will be composed without resort to the appeal body.

Avoid Made-to-Order Plans

SEVERAL typical employee representation plans will now be described briefly, but with the warning that made-to-order plans of this sort can seldom be applied to another company. It is much safer to study the details of plans that have been successful, and put these details before your own men so that the plant built up for your own plant will employ the good features whenever they can be made to fit.

A typical works council plan has been in operation in a western electrical manufacturing plant since 1918. This plant is divided into sections as identified by the various foremen. These sections are grouped to make up eight more or less closely allied divisions, and each of these divisions elects a chairman who sits on the general committee with an equal number of representatives from management. Each group meets at least once every six months and as much oftener as is necessary. An employee is not eligible to vote until he has been six months with the company and three months in the section from which he votes. There are two elections yearly, half of the board going out each six months.

To handle cases that cannot be settled by the general committee there is a board of arbitration of three; one member of this board is elected by the men from inside the company and one represents the management. The third member is elected from a list of six names—three submitted by the management and three by the board of representatives.

A somewhat less elaborate plan that follows the employee committee setup is in use at another western plant. Here the shop committee consists of seven employees selected by the seven districts in which the plant is divided, and holds office for two years. This committee elects its own officers.

An employee may report a grievance either to this shop committee or to his foreman. In the former case, if the grievance cannot be settled at once, it comes before a joint committee made up of the seven members of the shop committee and three representatives of

management. The management appoints the chairman, each side has one vote, and an agreement must be discussed at one meeting and voted on at the next meeting.

In cases where an agreement is taken up with the foreman instead of with the employee committee, he settles it if he can, and if not brings it up at the next production foreman's meeting.

An eastern company has had a successful experience with a cooperative association to which all employees belong. After three years' employment a man becomes a Class A employee and has two votes for members of the board of 15 counselors. A year of service is the prerequisite to eligibility for election to this board which organizes and elects its own officers.

The board appoints the various committees to deal with the different phases of employee activity, except when such committees are to sit jointly with committees of management. In this case, the company retains the right to ratify the membership of the committee appointed by the board. On written notice to the board, the company can appoint a committee, but the members of this committee must be subject to the board's ratification.

One of the original industrial democracy plans with the usual elaborate set-up of cabinet, senate and house of representatives, has been succeeded by a single so-called Betterment Committee which meets every two weeks. Members of this committee must have been six months with the company and voters also must be employees of six months standing. One representative is elected to each 20 to 30 people in a department. Any member of the management may attend meetings when he is invited.

Arbitration of questions disagreed upon by the Betterment Committee and the management is handled by a referee mutually agreeable to both sides. An interesting by-law in the set-up of this plan is that no member can speak over three minutes except by permission of the chairman.

The Chrysler Set-Up

ONE OF the most promising of the plans introduced since the enactment of NIRA is the one adopted by employees of the Chrysler Corporation last October. The plan was described in detail in the November 1933 number of *Factory Management & Maintenance*. The purpose of the plan is described thus in the letter sent to the employees by W. P. Chrysler:

"This is a plan which provides an opportunity for the employee to have an equal voice with the management in deciding jointly all matters affecting wages and working conditions. Its purpose is two-fold:

"1. To establish a mutually satisfactory way of settling any difference which may arise between employees and management, including rates of pay, shop rules, working conditions, safety, hours of labor, plant sanitation, employees' transportation, and recreation.

"2. To provide a means of friendly and lasting cooperation between employees and management on the basis of mutual consent and understanding."

In order to carry out these aims, the plan provides:

"1. That the employees may nominate and elect by secret ballot employee representatives to deal with the management on all matters of wages and working conditions.

"2. That the employee representatives so nominated and elected may serve on a joint council with an equal number of management representatives, which council shall hear and dispose of any questions referred to it by the employee or management.

"3. That in the event that the joint council cannot reach a satisfactory settlement itself, or in consultation with the operating vice-president, the matter will be referred to arbitration for decision, which decision shall be binding on all concerned.

"4. That mutually satisfactory procedure shall be established for the prompt and regular handling of any matters arising between employees and management through joint determination of the fact, and joint decision in which employees and management will have an equal voice."

In the final paragraph of his letter Mr. Chrysler says:

"I regard this plan as one of the most important things this company could do in the interest of the employees themselves. If I were again a shop employee I would vote whole-heartedly for it and I hope that you too will vote in favor of it."

The Chrysler organization being a large one—28,000 out of 33,000 employees voted for the plan—some of the details of organization are a little more complicated than was the case in the other plans we have mentioned. At each plant the elected representatives of the employees and the representatives of management meet to form a joint council, each side having an equal number of votes. An employee who has a grievance is supposed to try to settle it with his foreman if possible. If that fails he may bring it up through his employee representative to the joint council, after the representative has endeavored to settle the matter with the foreman, or later with the management's special representative. If the matter finally comes to the joint council it can only be settled by a two-thirds vote of all those present.

In Case of Dispute

IF A DECISION is not reached in this manner, the disputed point is referred to the operating vice-president of the plant division in which the council is located. He may confer with the joint council as a whole or any committee thereof, or any group of employee representatives, to bring out all the facts of the case. Then he has ten days in which to propose a settlement or to refer the matter to arbitration.

Arbitration being such an important part of any plan of this sort, I shall quote the whole section on arbitration to show how complete impartiality is assured. The section reads as follows:

"Whenever a matter is referred to arbitration, the operating vice-president shall meet with an employee representative selected by the employee members of the joint council for such metings, and the operating vice-president and the employees' representative shall then proceed to select an impartial and disintrested arbitrator. If they cannot agree upon an arbitrator, then within ten days thereafter the operating vice-president shall select one arbitrator and the employees' representative shall select another, and if these two arbitrators agree their decision shall be final. If they do not agree, within twenty days they shall select and call in a third arbitrator and the decision of the majority of these three arbitrators shall be final and binding in the matter."

Many other interesting experiments in this direction could be cited and details of their organization and administration quoted, but sufficient has been given here to outline the general principles. Further information can be obtained from the National Metal Trades Association, the American Management Association, and the National Industrial Conference Board.

In conclusion I can do no better than quote the final conclusions of the Metal Trades Committee on Industrial Relations, from whose report the statistics at the beginning of this article were taken. They are as follows:

"1. Employee representation plans have proved to be desirable and beneficial to both employer and employee in instances where they have been properly installed and efficiently supervised.

"2. Employee representation is primarily a function to give employees a voice in industrial organization so far as it affects their wages, hours and working conditions. Contrary to the belief of many employees and some employers, it is not intended to give the employees a voice in the actual management of the business of their employer. This is a very important point and should be carefully explained to, and thoroughly understood by, all employees in a plant where employee representation is being considered, so that there will be no misconception of rights and privileges.

"3. Simplicity is a highly desirable feature and it is a big factor in the administration of any employee representation plan.

"4. The NIRA has changed conditions to such an extent that employee representation is now more necessary in the small units than it formerly was.

"5. A plan introduced at an inopportune time will probably fail, and may even prove to be highly detrimental to both workmen and the management.

"6. A plan developed from an existing employee benefit or welfare association may defeat the real purposes of employee representation as well as the original functions of the association.

"7. It is the opinion of this committee that employers should do everything within their power to counteract the misrepresentation of facts by labor organizers and other non-employees. We believe that the demand for employee representation is here, and that the time is at hand when every employer should provide some means whereby his employees can present their problems and suggestions to the management through the medium of special representatives, committees, or in other ways when it is not practical to conduct all bargaining on an individual basis. The preservation of cordial relations between employer and employee is essential to the successful operation of industry. It seems imperative, therefore, that necessary changes and adjustments in working conditions should be determined through joint conferences between an employer and his employee."

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ONE MIGHT sum all this up in the statement that if the employer intends to play fair, does play fair and makes it clear to his employees that he is fair, there is every reason to expect that they will meet him half-way and that they will play just as fairly as he does. After all, the average American workman is nobody's fool. He realizes that his livelihood depends on the successful operation of American industry and of the company for which he works, and he will do his part if he is assured that he is not being imposed upon.

Disappearing Drill Press

PAUL KORNA

Frank C. Hudson's article (*AM*—Vol. 78, page 115) about the ancient radial drill press recalls an incident that I experienced with a similar machine.

Long ago, when anyone could get a machinist's job and I was foreman in a small shop, I hired a dub just in from the country. He was put to work on a radial, drilling about a 1-in. hole in each end of a long I-beam. As the press was located in a dingy corner of the shop, away from everybody and close to the wall, it was necessary to let one end of the I-beam stick out of the window.

After the usual instructions on how to start and stop the machine and throw in the feed everything went fine the first couple of hours. I told the operator that if he had any trouble to come and tell me, that I would be at the other end of the shop. The press was driven by a belt, tight and loose pulley, from an overhead countershaft driven by a gas engine in the cellar.

Well, he came over, and this is what he said: "My drill press is gone."

"Gone? What are you talking about?"

"Well, it isn't there any more."

So I went over with him, and sure enough, the radial press was gone. This is what happened. He had started the machine and thrown in the feed; then he went to get a drink at the other end of the shop. In some way the drill, in going through the work, got caught and broke; the I-beam fell out of the window and knocked the belt off the pulleys so that it caught on the radial column and the top countershaft in such a way that it gave an awful yank, breaking the column close at the base and wound it up against the high dark ceiling where it could just about be seen. In the meantime the extra strain on the lineshaft had stopped the engine. After everyone had come around we turned the engine backwards and let the wreck down. It was now 100 per cent scrap. We paid off the dub and bought a press of a later type.

Bearing Metals and Pressures—Discussion

C. G. WILLIAMS

In (*AM*—Vol. 77, page 666) John R. Godfrey brings up the question of pressures on bearings and refers to steel against steel as permissible, providing the steel is very hard. In a test some twenty years ago a small experimental mechanism was found to cut any type of bearing metal used. Agate was at last used, but the pressure was so high that the bearing was split after about an hour's run. A second bearing was made and tests carried on to determine the temperature of the bearing, as statements were made that heat rather than pressure broke the bearing. This second bearing broke within one hour and the temperature showed a rise of but 5 deg. F.

I made a tool steel, 1.25 per cent carbon, collar for the shaft and as there was no mercury to be obtained on short notice, tempered it in a lead bath. A bearing was also made of the same material, and it likewise was tempered in lead. A file would touch either the collar or the bearing, yet they ran together for months.

High Speed Bearings

I have also made steel bearings to run at 50,000 r.p.m. The steel shaft and bearing would be heated in a closed gas furnace so that air could not reach the metal. From the furnace a small chute ran down into a small bath of mercury. When the bearing was heated sufficiently it was rolled to the chute and allowed to slide down into the mercury. When taken out, it was as bright as when put in the furnace. The shaft was tempered in the same way. The steel was so hard that an emery wheel would not touch it and a broken corner would scratch glass as would a diamond. This mechanism ran for two years, and within that time only a teaspoonful of oil was used to lubricate it.

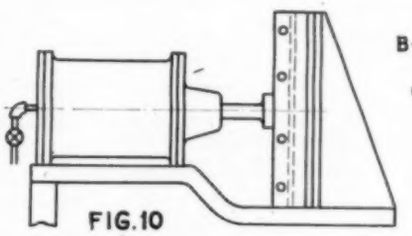
Making and Repairing Crossheads—II

A second and concluding article on the way in which well-known railroad shops in different sections handle their crosshead problems

THERE are many types of fixtures used in babbitting crosshead shoes, each design being influenced by conditions in the shop. Fig. 10 shows a device which utilizes an old air brake cylinder for holding the shoe against an angle plate in a vertical position. First the cover plate *A* is placed on end, against the angle plate. Then the crosshead is put in place with the bolt holes toward the cylinder. Two wooden strips *B* are placed between the plate and the crosshead. Air admitted to the cylinder clamps these in place leaving the space *C* for babbitt. The babbitt is poured in at the top. This fixture is easily handled, prevents leakage of babbitt at the joints and is fast in operation.

The crosshead shoe used on another railroad is only babbitted at the bottom as at *A*, Fig. 11. A very simple fixture handles this work. It consists of a steel bar *B* which is practically a duplicate of the guide bar as it fits between the sides of the shoe and confines the melted babbitt in the proper place. The thickness of this bar determines the minimum thickness of the babbitt.

Near each end of the bar are cross pieces *C* which support the bar *B* by resting on the sides of the shoe. On each end of each strip is a screw by



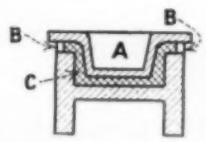


Fig. 10—A discarded air-brake cylinder is used to hold the crosshead shoe and the mold against the upright while the babbitt is poured

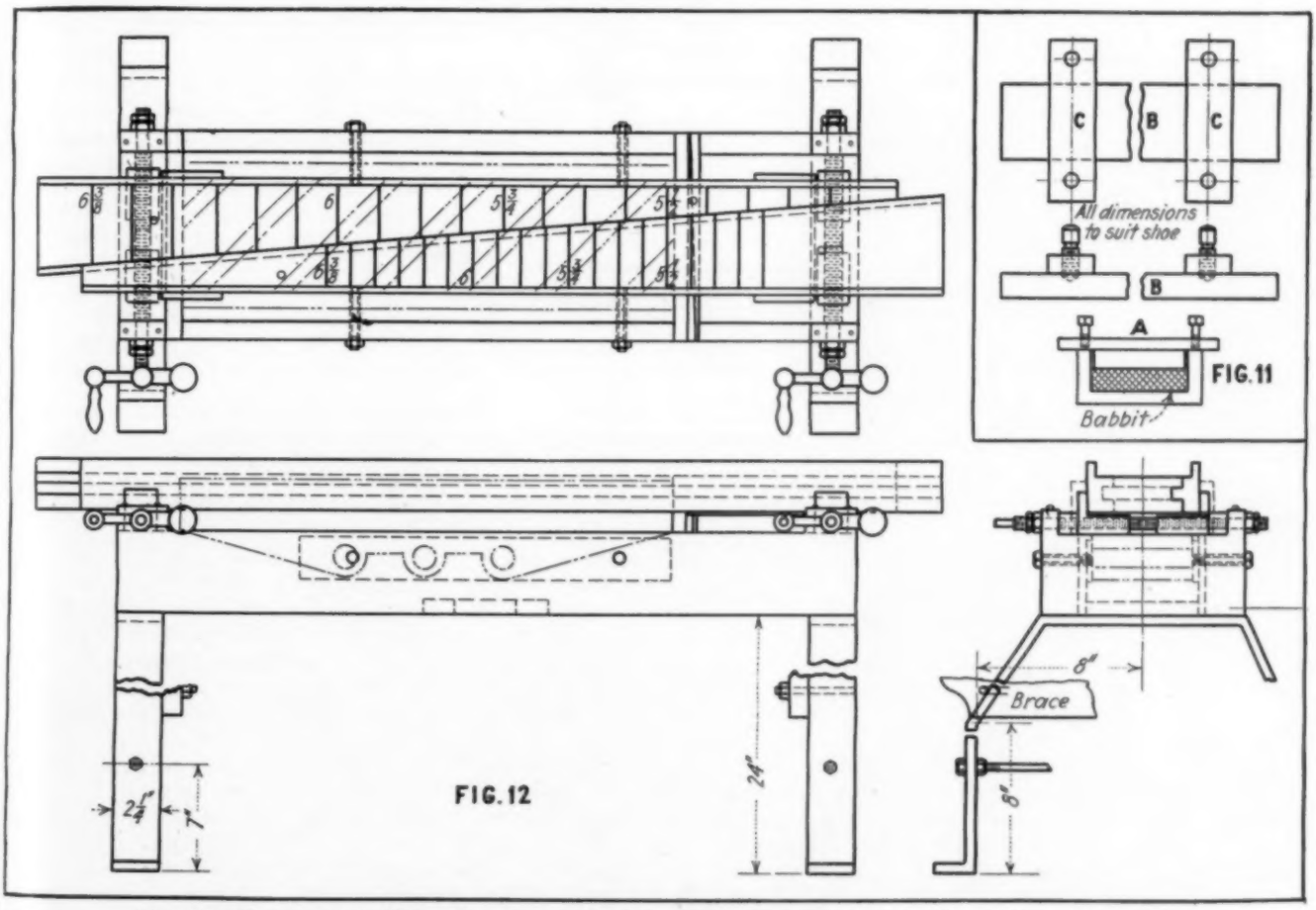


Fig. 11—One road babbitts the shoe with this simple device. Fig. 12—Shoes of varying width are babbitted in this fixture which is easily adjustable. It is supported at a convenient height

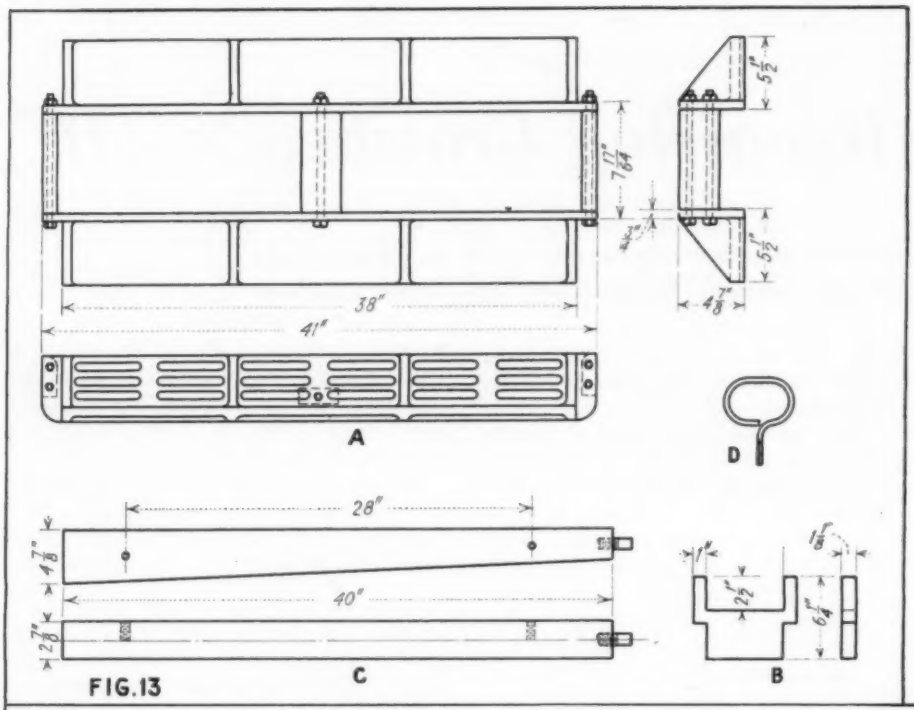


FIG. 13

Fig. 13—Another very complete babbitting fixture which utilizes a cast iron grate or side bar for holding the crosshead shoe while preparing it. This also has tapered wedges for adjusting width

Fig. 14—Boiler plate is largely used in building this fixture. The end pieces slide to fit different lengths. Construction details are shown as well as the way in which they are assembled and used

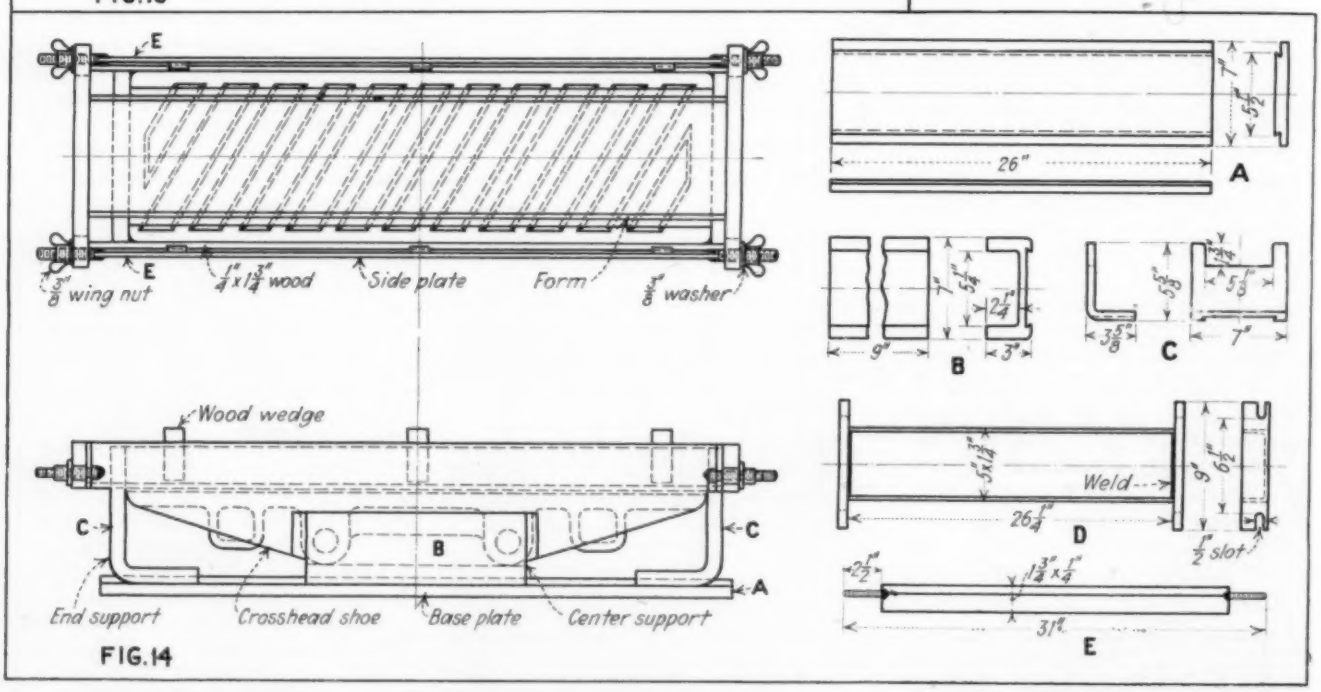


FIG. 14

which the bar can be raised to increase the thickness of the babbitt whenever desired. With this bar held in place by any sort of a clamping device it is easy to pour babbitt of the thickness required. This is an inexpensive fixture well suited to small shops or shops with a great variety of crossheads to keep in order.

In Fig. 12 is a much more elaborate fixture for babbitting crosshead shoes of widely varying width. This is a carefully designed fixture that takes advantage of the wedge principle to secure the variations in width. It is graduated for widths from 5⅛ to 6⅜ in. By moving the wedges until the figures showing width desired are opposite each other, the slide is set for that dimension.

The general construction of the fixture can be seen from the three views, both plan and end view showing how the side clamps are operated by two right- and left-hand screws. The location of the shoe is seen in dotted lines. The babbitt is poured with the shoe in a horizontal position. The fixture stands on the floor, it being 24 in. to the under side of the bed. The total width is 16 in. to the inside of the legs, which are of ½x2¼ bar steel. Hardwood cross braces are clamped to each leg by hook bolts, a ½-in. rod also ties the legs together below the brace. The projecting ends of the brace can support a plank to assist in handling the shoes.

A somewhat similar fixture is seen in Fig. 13. Here a cast-iron grate or side bar *A* is used in preparing the shoe for babbitting. With the shoe placed on the grate the end pieces *B*, which are of cast iron, machined all over to suit guides of different widths, are placed in each end. Then the tapered bars or wedges *C* are adjusted to the proper width in the end pieces, forming the mould for the babbitt. After pouring, the eyebolts *D* lift out the bars.

Boiler plate plays a large part in the fixture shown both assembled and in detail in Fig. 14. It consists of a base plate *A*, of ¾-in. boiler steel, planed with a 30-deg. dovetail 5½ in. wide and ¼ in. deep. On this is mounted a cast iron center support *B*, dovetailed to suit the base. Two end supports *C*, of ⅝-in. boiler plate also slide on the dovetailed base. The form *D* which represents the guide, is of 1¼x5-in. channel steel with ⅝-in. plates welded at each end. Half-inch slots are cut in each end plate to receive the clamping rods *E*. These are of ¼x1¾-in. flat iron with ⅜-in. studs welded at each end.

With the fixture on the bench for convenience in handling and the preheated shoe in place, the end plates are moved up against the ends as at *C*, in the assembled fixture. The shoe is then swabbed with muriatic acid and tinned. Then the form or core *D* with the side plates attached and nuts tightened is set in the shoe, resting on the end supports and allowing clearance all around for babbitt. Wooden strips, ¼x1¾-in. are placed between the side plates and on the outside of the shoe, adjusted to the proper height and fastened against the sides of the shoe by driving in small wooden wedges. All cavities or openings that might permit the escape of babbitt are plugged with asbestos and the babbitt poured from a small ladle while the shoe is still hot. The shoe is allowed to cool thoroughly before machining the babbitted surfaces.

Railway Motor Repairs

CHARLES F. HENRY

WHEN a railroad starts to use electric motive power it introduces new problems for the shop man as well. Two of the jobs that go with electric motors are shown in the accompanying illustrations from the multiple-unit department of a shop of the Pennsylvania Railroad.

First is the winding of the armature banding wires as in Fig. 1. This is done in almost any lathe of sufficient swing with the addition of the wire control apparatus shown. The banding wire runs over the grooved pulleys and through the tension clamp at the top. An electric soldering iron is also part of the equipment as the wires must be securely soldered to hold them in place.

The other job in the same shop is the undercutting of the insulation between the bars of the commutator. This insulation is usually of mica, which is rather gritty and hard on cutting tools. Fig. 2 shows the attachment mounted on the headstock of the lathe. The column *A* carries the square arm *B* out over the work.

Mounted on this arm is a head *C* with a milling spindle beneath and a motor above, while a rack and pinion moves the head along the bar. The spindle, carrying the slitting saw *D*, is driven by an endless belt. An air jet from the pipe *E* blows the dust and chips away from the cutter.

This device is not difficult to make and handles a lot of commutators in a month.

These motors weigh 6,375 lb. each, the armature accounting for 2,400 lb. The armature is 22.5 in. in diameter and the commutator 19 inches.

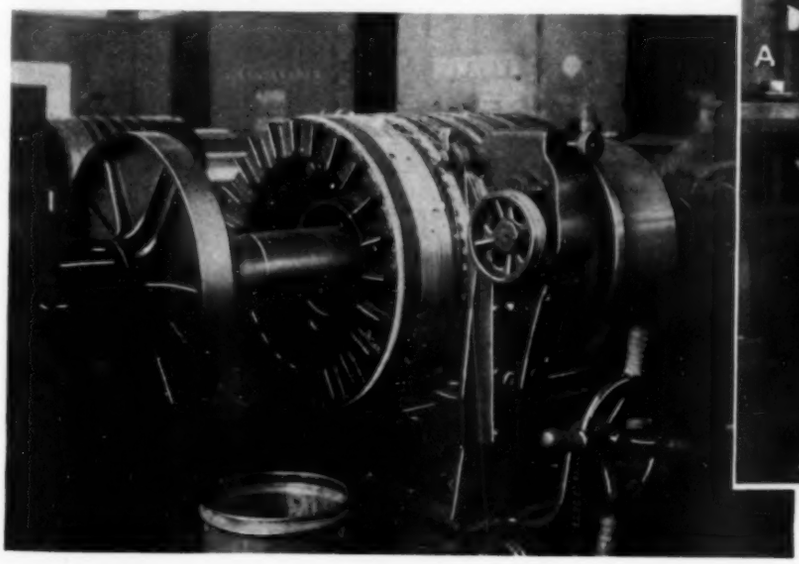


Fig. 1 — Below — Putting banding wires on an armature for a multiple-unit railway motor. The special attachment carries the banding wire and gives it the proper tension

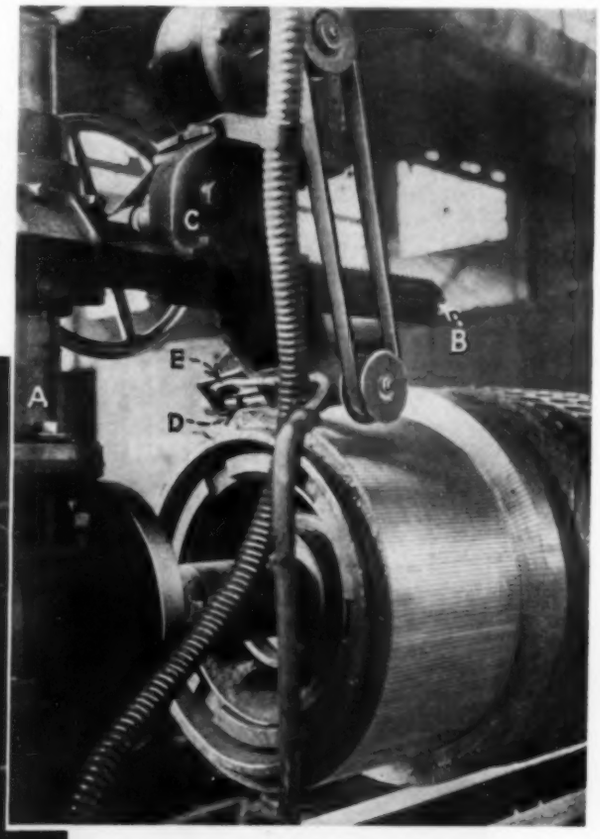
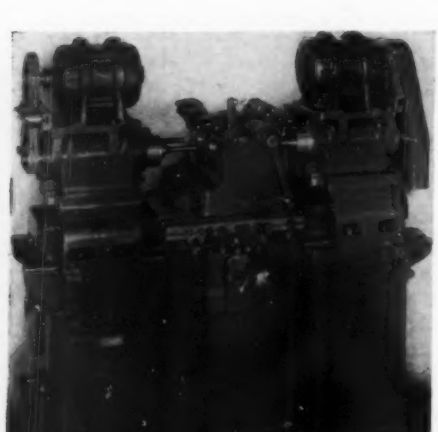


Fig. 2—This undercutting saw is carried on a bar and travels over the commutator

Comfort in the Shop

Now that air conditioning apparatus is gaining ground so rapidly it will pay shop managers to see what can be done to make conditions more comfortable for their men. It is a far cry from the old bat-wing fan that we used to fasten to the line shaft when conditions permitted to real air conditioning. But just as the old fan helped by making the shop bearable on a sweltering day, so will the newer and better apparatus improve both output and shop morale. No man works well with sweat running down his nose or back. And if he knows that it can be prevented he's going to be hotter than ever.



A boring machine adapted for machining the piston pin holes in automobile pistons

Heat-Treatment Contributes to Accurate Bores

J. B. NEALEY
American Gas Association

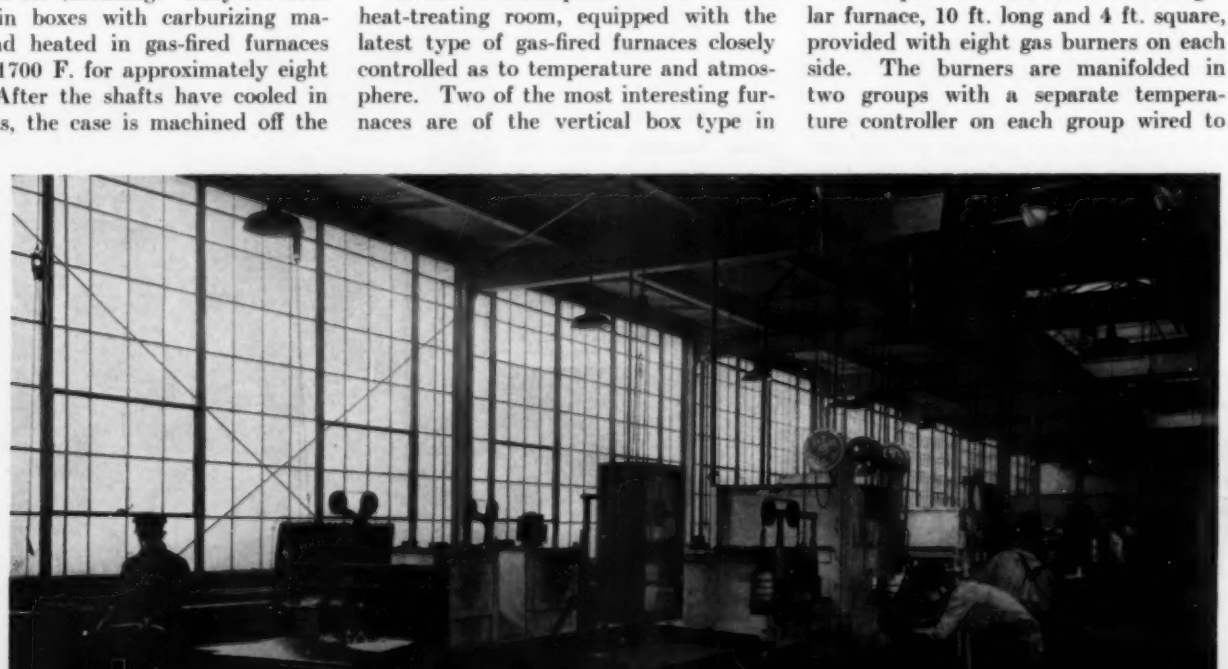
HEAT-TREATMENT of the key parts of the Ex-Cell-O Aircraft & Tool Corporation's boring machines is vital to the life of the machine and quality of the work produced. To illustrate this a few examples of the work done on these parts will be given.

The spindle shafts of SAE 3120 steel are first roughed out leaving stock in both ends for threading. They are then packed in boxes with carburizing material and heated in gas-fired furnaces to 1650-1700 F. for approximately eight hours. After the shafts have cooled in the boxes, the case is machined off the ends, and they are reheated to 1550 F. for one hour and quenched in oil. Drawing is done at 600-700 deg. F. and produces a hardness of 55-60 Rockwell C scale. The parts are then finish-machined and ground. Piston rods, hydraulic control plungers, shafts and bushings are of approximately the same steel and receive practically the same treatment.

The boring quills of SAE 6145 steel (chrome-vanadium) are quenched at 1550 F. and drawn at 350-400 F. which produces about the same hardness. After the first draw over-all, the thread ends are drawn separately in a lead bath to obtain machining softness.

All this is accomplished in a modern heat-treating room, equipped with the latest type of gas-fired furnaces closely controlled as to temperature and atmosphere. Two of the most interesting furnaces are of the vertical box type in which the work, mostly long shafts and broaches, is handled in and out through an opening in the top. These are composed of steel cases lined with refractory material in such a way as to form a tall cylindrical heating chamber. Heat is supplied through two vertical rows, one on each side of five burners each. Each row is manifolded to a venturi gas-air mixer and both manifolds are served with a single gas line into which is cut a motor valve connected to an automatic temperature controller with recording pyrometer. Circular steel tanks are provided for quenching, and the work is handled by means of an overhead monorail and hoist.

These parts are drawn in a rectangular furnace, 10 ft. long and 4 ft. square, provided with eight gas burners on each side. The burners are manifolded in two groups with a separate temperature controller on each group wired to



Temperatures are controlled and retarded automatically in this well arranged layout

two motor-operated valves in the gas supply lines. There are eight venturi mixers, and gas is supplied at about 10 lb. pressure. The work is put in shallow boxes resting on a roller table for ease in loading.

For carburizing, a box type furnace, 10 ft. long 4 ft. wide and 5 ft. high, is set in a pit so as to bring the hearth to floor level for each in loading and unloading. It is underfired with four burners on each side, and a venturi mixer is manifolded to each two burners. An automatic temperature controller with recording pyrometer actuates a motor operated on and off valve in the single gas line supplying the burners. In addition there are three tell-tale lights, red, white and blue, to indicate at a distance whether the temperature is too high, too low or just right.

For miscellaneous heat-treating, there is a row of eight batch type furnaces all underfired with three to four burners to a side. These are like the carburizing furnace but smaller. There is also another group of batch type furnaces and included in it is a small cyanide furnace and lead pot. Close by is a cyanide furnace, 4 ft. in diameter and 3 ft. high, heated with four gas burners manifolded to a single venturi mixer. These fire tangentially to the inner wall.

Another group includes several cyanide furnaces, lead pots and oil baths. Water and oil quenches are located convenient to each group as are visual and recording pyrometers with multipoint switches so that the temperature in any unit can be quickly obtained or recorded. For high-speed steel, two small furnaces are mounted one above the other; the lower, which is used for high heat, has four burners, and waste heat from this is allowed to rise into the upper (used for preheating through a couple of alloy steel tubes. The burners under and overfire the work from opposite sides and are manifolded to a single venturi mixer.

This heat-treating division, together with a well equipped plant and an up-to-date laboratory testing and engineering department, makes possible the precision needed.

Two vertical gas-fired furnaces which are used for long shafts and broaches

Another view shows the cyanide pot and quenching equipment

Rehabilitation of Industrial Plants

RALPH E. FLANDERS
President, Jones & Lamson Machine Company

THE PROBLEM of boom, depression and recovery centers about the corresponding activity, collapse and revival of the capital goods industries, and the banking operations by which they are financed.

Early in this depression Dr. Virgil Jordan, then economist of the "Business Week," calculated that the entire drop in business and in employment could be accounted for by the drop in the capital goods industries, plus the decrease in the consumer goods industries and service occupations resulting from the recession in capital goods. Mr. Leonard Ayres has collected information leading to similar conclusions, and more recently Mr. George Houston and others have reemphasized the importance of this factor.

Monetary Troubles

At first thought these conclusions seem to be at variance with the beliefs held by other students to the effect that our troubles are essentially monetary, and that if we properly govern the expansion and contraction of currency and credit, or the value of the dollar, we will escape in the future some measure of the evils which have lately befallen us.

Now I am one of those who hold this view, but I am also convinced of the fundamental importance of the capital goods industries and of the variations in their activity. Indeed, it seems more or less clear to me that the monetary problem and the capital goods problem are two aspects of the same situation, tied together by the relations of our profit-motive and credit-money economy, wherein the actual amount of our money, as well as the activity of business and the volume of employment, depend on business enterprise. However, this matter is outside of the assigned topic, so it will be passed over with this brief mention.

Both governmental and private policies affect the demand for capital goods in general, and for machinery and equipment in particular. Until recently the governmental factor has been the controlling one. Certain changes in policy and proposed modifications in legislation in the last few weeks, indicate that the bars to recovery from this direction are being raised. If this happy event actually takes place, private business and private finance will have the major responsibility placed definitely in their hands. The question is, will private enterprise rise to the challenge; or have we suffered too long and too debilitating a dependence on federal bottle-feeding? That is the question I propose to discuss.

It may be well to describe a typical transaction (or better "occurrence," for "transaction" is too positive a word) in the experience of a capable salesman of machinery or equipment. He works for a firm that is both substantial and progressive. It has had the resources, the vision, the courage and the inventive ability at its disposal to keep men successfully employed during the depression on the improvement of its product. Its 1934 line of machinery is more productive per dollar of first cost and per dollar of labor cost, is more efficient in power consumption, turns out a better and more accurate product, is less subject to wear and breakage, and is in all other ways superior to the 1929 model. As a matter of fact, it is competing with the 1929 model in only a scattering of cases, for the shops of the nation are crammed with machines of all vintages, including an ample supply of genuine pre-war stuff. All of these antiques, by the way, figure in the total when our frightened statisticians reckon up the "overcapacity" of the nation's industry.

The author's term of office on the Industrial Advisory Board gave him an insight into national problems that is reflected here as clearly as is his long experience in the building of machine tools. Brain trust economists would do well to check their theories against the practical experience of men like Mr. Flanders

To Close An Order

Full of confidence in his firm, its product and himself, our salesman sets out to convince a customer and close an order. Being an experienced man, he applies his persuasive powers to every individual involved, from the departmental foreman to the general manager and the president. He does not fail in any way to bring the charms of his personality and his skill in dialectic to the task in hand. But his main reliance is not on these more spectacular aids. His main reliance is on a cool, honest, engineering analysis of the work the customer has to do, and of the efficiency of his machine in the doing of it. He knows that in the long run there will be no worthy success for himself or for his company in sales made on any other basis; and on this basis he wins over his prospect and sees the requisition made out by the proper authority.

Thus the salesman gets his order—or so would he have gotten it in the old days. Now it is only a first step, and all too often a step which leads nowhere. The requisition is met higher up with an announcement of fixed policy, "no capital expenditures," or it is accepted as tentatively desirable, considered, debated and finally shelved. It matters not that business on the whole is improving. It matters not that the purchase is justified on the present scale of operations. It matters not that on that scale the new equipment will pay for itself in five years, or one year, or even in six months. It matters not that the customer has available resources or

An address before the Chamber of Commerce of the United States at Washington, May 3, 1934.

credit. In thousands of cases in the past months every element has been favorable; yet somewhere along the line—in the Board of Directors, in the controlling forces of the customer's banking connections—somewhere there has been a cold, dead hand which closed around the throat of what had been a beautiful and healthy business prospect.

Let it be admitted at once that the situation thus described has been slowly altering, and for the better. Let credit be given to the changed governmental attitude as the principal single cause of that improvement. Yet the tendency still persists, in a degree so widespread as to be a serious brake on the progress of recovery. We will do well, therefore, to look the situation in the face, to see what there is that may be justifiable in this reluctant attitude. Is it an expression of proper caution, or is it a senseless, subconscious fear that holds us bound—a hang-over from the terrors of deflation?

It has seemed to some of us that there is such a subconscious fear, a sort of Freudian complex; and that this fear-complex is the irrational conviction that we are over-equipped now, and did over-produce in 1929.

Too Much Capacity?

Such beliefs are buttressed by a formidable collection of facts. We have all the railroads we need—no call to build more of them. There are too many coal mines. Wheat and cotton have smothered their markets. We no longer have a frontier, calling for expansion and development. Immigration has ceased and the population curve is beginning to level off in its rise. Even in 1929 our industrial capacity was not fully taxed, nor were all of our workers employed.

This, and much more than this, is all true. In part it is a statement of unfinished, large scale adjustments as between agriculture and industry, or as between different branches of industry, or as between industry improving in efficiency and the young and growing service occupations. These needed adjustments, delayed and intensified by the war, and again accumulated during the stagnation of the depression, constitute a serious problem.

But the seriousness of this problem disappears in the constructive possibilities which open before us. For we did not overproduce goods and services as a whole in 1929, nor have we ever done so at any other time. No nation with natural resources, character of population and inventive and organizing genius comparable to ours, in which that large part of the population which is able and willing to work has no better food, clothing, shelter and cultural satisfaction than we enjoyed in the boom of 1929, can be said by any stretch of the imagination to have over-produced. We were at that moment, and before, and since, suffering from under-production.

Stop Speculating

We have two things to do—rid ourselves of fear, and rid ourselves of folly. I have said something about the fear. There is also time for a word or two about the folly.

We must learn to be content with business profits—with the solid social rewards which come from the exercise of wealth producing, not wealth appropriating, activities. It will always prove fatal to make our principal interest the search for illusory and unsocial speculative gains.

Business must not seek to protect itself unduly, but must be willing to undergo the dangers of such a degree of competitive freedom as will insure the continued success of efficient management, and encourage the passing on of the fruits of that efficiency to the consumer, in terms of lower prices.

Financial interests must refrain from building up top-heavy credit and speculative structures, and must be willing to look to true business service for their profit. In general, credit expansion must be confined to the financing of current production and distribution, leaving investment to be supported by savings. Better provision for the free flow of savings into investment is an essential to recovery; and the refusal of large scale credit inflation as a support to investment is essential to the prevention of a boom and collapse. This was the immediate critical element of the period 1926 to '29.

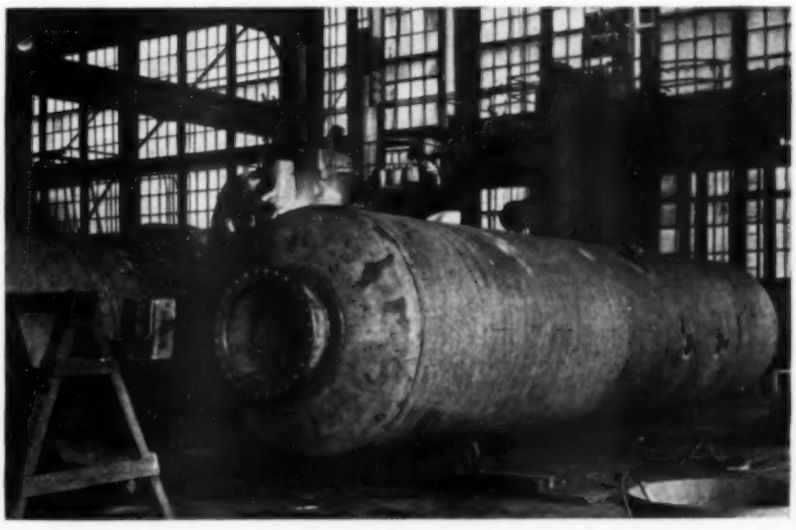
We must avoid these follies. Then we need not fear. For we still have frontiers ahead of us. They are no longer geographic ones, they are social frontiers.

One of these social frontiers is the forty-hour week—a new determination of the balance in human values between labor and leisure—a dividend of our improved machinery and management partly earned by past performance, partly owed in faith of future efficiencies not yet attained. That frontier has only been rudely mapped. It has not been occupied and settled. It is going to take better machinery, better methods, better organization than we have ever had to maintain that frontier position, and at the same time make that advance in the general standard of living which constitutes our other social frontier.

Guiding Stars of Business

These hopeful prospects, these justifiable ambitions, should become the guiding stars of business, of finance and of government. Our profit-motive, credit-money economy is capable of progressing steadily toward them. No other form of social organization has made such progress toward them in the past. None holds such solid promise for the future.

Critical judgment and *caution* are the qualities demanded in the flood tide of prosperity. But the need of the present is for critical judgment and *courage*.



***Stainless Tower*—Constructed by the Foster Wheeler Corporation for the distillation of fatty acids, this 20-ton fractionating tower is one of the first large pressure vessels to be built of arc welded stainless steel. The two sections are connected by a butt strap. Lincoln Electric Company's shielded arc process was used for all welds**

A Jig Policy Put Into Practice

WHAT is a ¼-in. jig bushing? Technical Committee No. 8 of the American Standards Association is now in the process of deciding. But in the meanwhile hundreds of machine shops each have a score of answers. Bushings of the same nominal size will be found varying by sixteenths in length, in wall thickness and in flange dimensions until the aggregate combinations approach infinity. This quantity multiplied by the sizes in general use gives a picture of complete diversity in the many shops where rugged individualism is the predominant feature of tool design.

Fortunately, a good percentage of shops has appreciated the savings possible through standardization in jig and fixture parts. A good example of this group is the Heald Machine Company which has gone even further than the average shop by standardizing on design principles as well as on the parts themselves.

Tool problems at Heald are typical of those found in a great number of plants doing accurate work in limited lots. Many of the jigs serve to locate drilled or bored holes in precise relation to plane surfaces or other holes in the same part or in mating parts. In designing these jigs the following principles are observed:

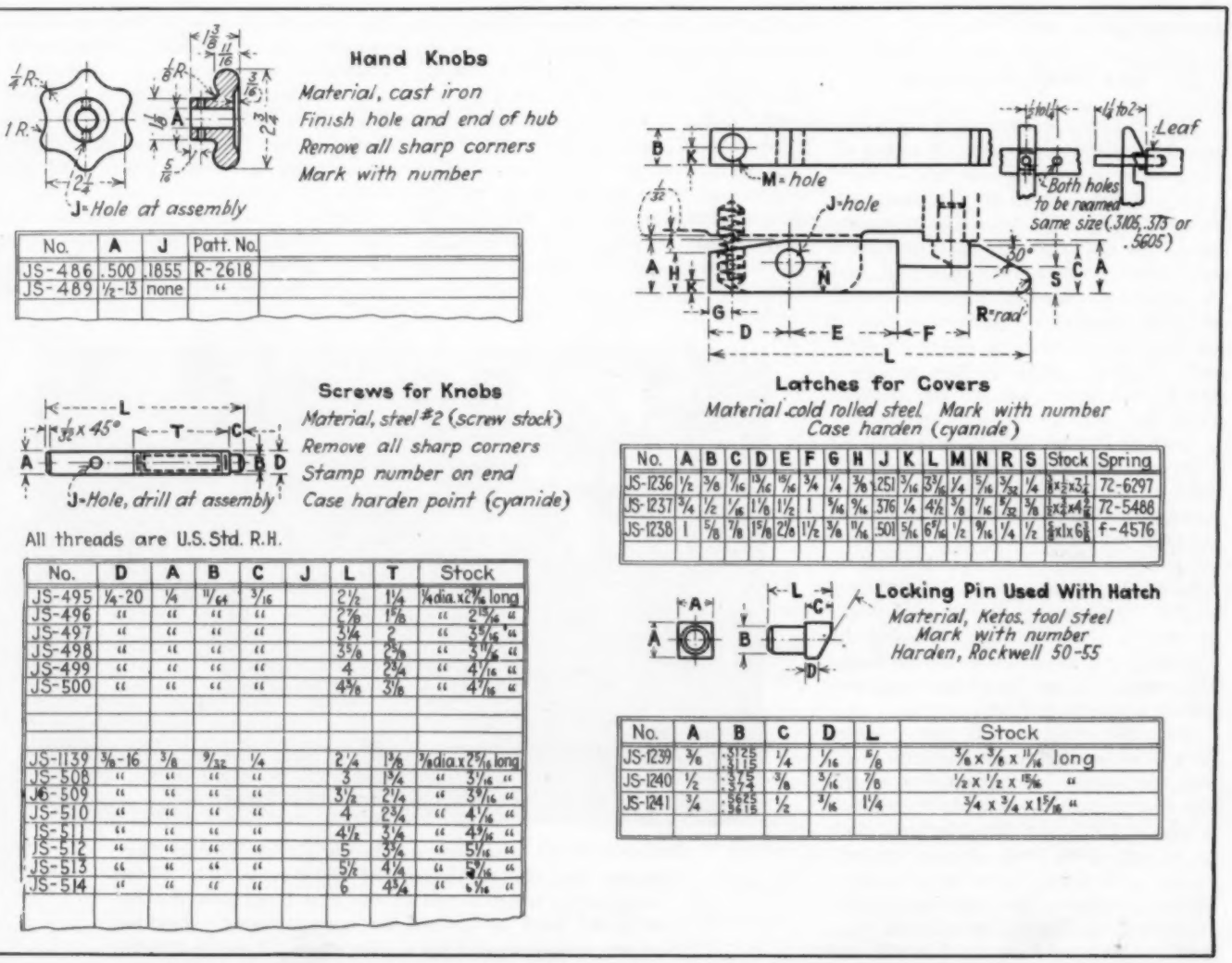
1. Standard clamping knuckles are employed to give the work two-way location.

2. Automatic locking latches serve to hold the lids of box jigs.

3. Press fit bushings are used where possible instead of slip bushings.

In many instances, bored and drilled parts are located from three plane surfaces, usually at right angles to each other. The conventional design is to have the bottom of the jig take care of the base of the piece and to provide two locating strips which fix the position in the other two planes.

In this type of jig it is important the work be seated quickly and accurately against these strips. At the Heald plant the locking knuckle, illustrated in Fig. 1 is used. The advantages of this design are that it locates the work in both planes simultaneously, and because the device is self-equalizing, the force appiled is the same in each plane. Its action is speedy and positive. It is simple to make and has a wide application. The knuckles are actuated by means of knobs that have also been standardized. Obviously a great saving can be realized



No.	A	J	Patt. No.
JS-486	.500	.1855	R-2618
JS-489	½-13	none	"

No.	D	A	B	C	J	L	T	Stock
JS-495	¼-20	¼	11/64	3/16		2½	1¼	¼ dia. x 2 5/16 long
JS-496	"	"	"	"		2⅞	1⅝	" 2 15/16 "
JS-497	"	"	"	"		3¼	2	" 3 5/16 "
JS-498	"	"	"	"		3⅝	2⅜	" 3 11/16 "
JS-499	"	"	"	"		4	2¾	" 4 1/16 "
JS-500	"	"	"	"		4⅜	3⅛	" 4 7/16 "
JS-1139	⅜-16	⅜	9/32	¼		2¼	1⅜	⅜ dia. x 2 5/16 long
JS-508	"	"	"	"		3	1¾	" 3 1/16 "
JS-509	"	"	"	"		3½	2¼	" 3 9/16 "
JS-510	"	"	"	"		4	2¾	" 4 1/16 "
JS-511	"	"	"	"		4½	3¼	" 4 5/16 "
JS-512	"	"	"	"		5	3¾	" 5 1/16 "
JS-513	"	"	"	"		5½	4¼	" 5 5/16 "
JS-514	"	"	"	"		6	4¾	" 6 1/16 "

No.	A	B	C	D	E	F	G	H	J	K	L	M	N	R	S	Stock	Spring
JS-1236	½	⅜	7/16	13/16	15/16	¾	¼	⅜	.251	3/16	3 3/16	¼	5/16	3/32	¼	¾ x ½ x 3¼	72-6297
JS-1237	¾	½	7/16	1⅛	1½	1	5/16	⅝	.376	¼	4½	⅜	7/16	5/32	⅜	¾ x ½ x 4 7/16	72-5488
JS-1238	1	⅝	⅞	1 5/16	2⅛	1½	⅜	11/16	.501	5/16	6 5/16	½	9/16	¼	½	¾ x 1 x 6⅛	f-4576

No.	A	B	C	D	L	Stock
JS-1239	⅜	.3125 .3115	¼	1/16	⅝	⅜ x ⅜ x 11/16 long
JS-1240	½	.375 .373	⅜	3/16	⅞	½ x ½ x 15/16 "
JS-1241	¾	.5625 .5615	½	3/16	1¼	¾ x ¾ x 1 5/16 "

Fig. 2—Reference sheets give tabulated dimensions of standard jig parts of various sizes

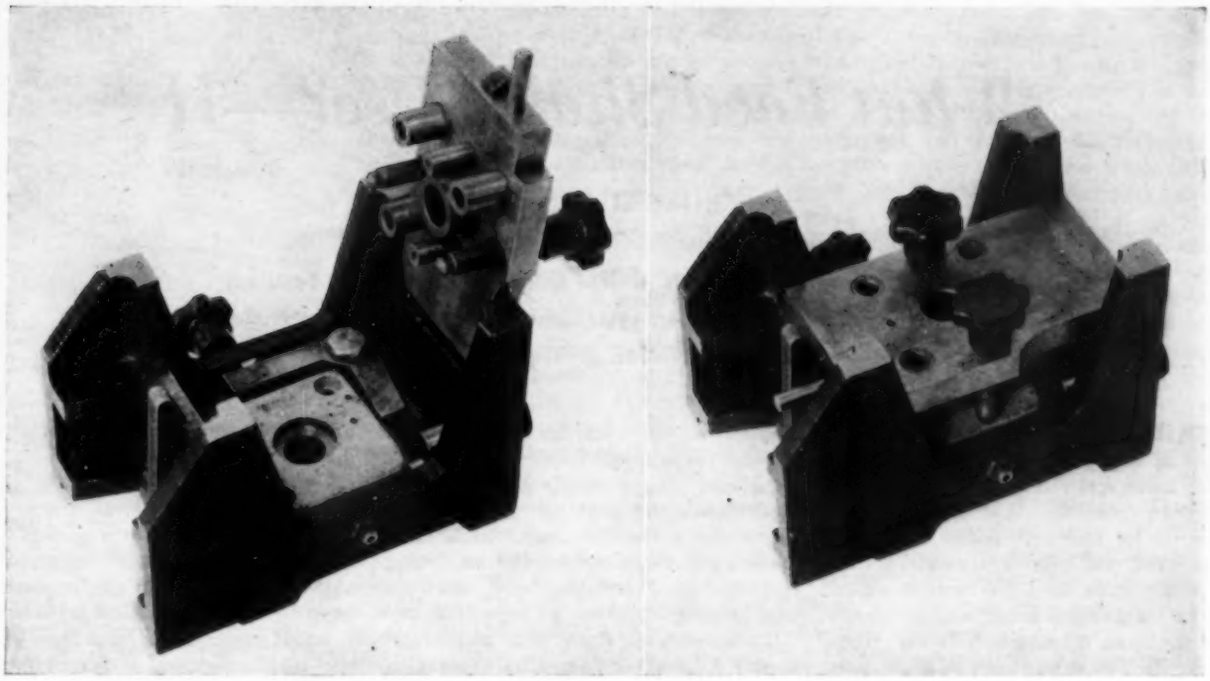


Fig. 1—Two views of a typical jig show the latch, clamping knuckle and fixed bushings

by making knobs, bushings and other common parts in lots and drawing them from stock as needed.

Another time saver is the self-locking latch which clamps the lid as soon as it is dropped without further attention on the part of the operator. A light push is all that is needed to release the latch when the lid is to be raised.

The use of fixed bushings eliminates loose parts and the possibility of their loss. The time in handling is saved, and there is no chance of getting a bushing in the wrong location when holes of nearly the same size are close together in the jig. For reaming and tapping the lid is lifted with the bushings intact.

Fig. 1 shows two views of a jig made according to the principles outlined. In addition to the points already mentioned, it will be noted that the locating points are locked adjustable screws. These are useful when there is any considerable variation in the castings, which are purchased from an outside foundry. For small pieces, such as that illustrated, the adjustment might never be used but for larger castings where there may be a variation in wall thickness this feature often proves convenient.

In Fig. 2 are shown tabulated dimensions for standard knobs, knob screws, latches and latch pins. A number of sizes of each are available for which the most suitable may be selected for a particular jig. Dimensions which are not varied are put directly on the detail.

These tabular dimensions are for use in the engineering department and are not sent to the shop. Instead a blueprint of a form, similar to that shown in Fig. 3, is filled in. The operator has only a single set of dimensions to work to thus reducing the possibility of error.

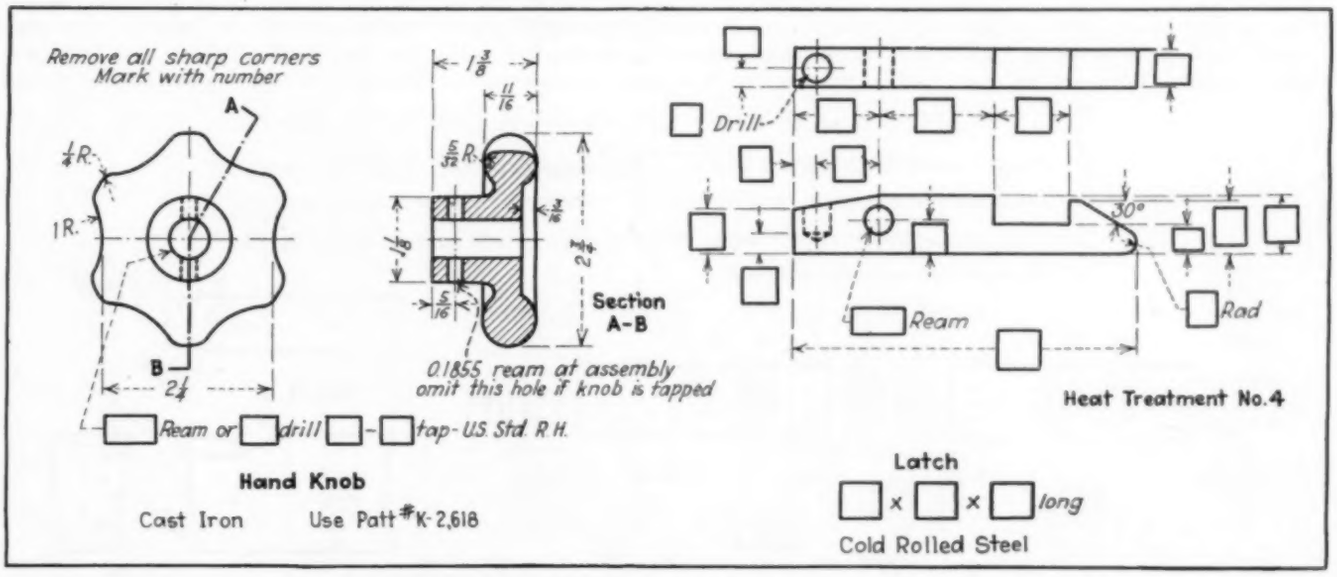


Fig. 3—Shop blueprints are made from tracings with constant dimensions given and spaces left for the variable dimensions

What Feed Shall I Use?—II

ROBERT C. DEALE
Secretary, A.S.M.E. Subcommittee on Metal Cutting Data

In the second half of his article the author analyzes feed on a screw machine job and establishes a relation between the effect of feed variation on cast iron and on steel

THE GEAR shifter shaft, shown in Fig. 8, is rough finished on a hand screw machine for final finishing by grinding. Calculations were made as for the part shown in Fig. 1 (*AM*—Vol. 78, page 270), except that an hourly rate of $0.60 was assumed for the machine operator, and all speeds were based on a tool life between grinds of 120 min., as determined in a previous article (*AM*—Vol. 77, page 517). As in the first illustration, unformed bar steel was used as a tool, ground for this job as shown in Fig. 9. A heat-treatment charge of $0.25, which was applied but once in its life, was used, and all tools were assumed to be ground in the toolroom. Table IV is based on calculations exactly similar to those for Table I, while the total cost was plotted as a function of the feed in Fig. 10, to give the same type of curve as already obtained in Figs. 3 and 7. Again the cost drops rapidly at first, with a marked flattening out at a feed of about 0.040 to 0.050 in. per revolution.

The marked similarity of the curves in Figs. 3, 7 and 10, indicated that, in all probability they were very similar in form, while the shape suggested that they might be some form of hyperbola, which might be represented by a common formula. Inasmuch as change of feed has no effect on the handling time, it was thought advisable to split the total cost into a constant cost, which represented the cost of the handling time, and a variable cost, which was made up of the tool cost, the machining cost, the tool changing cost and the tool grinding cost.

These variable costs were plotted on double logarithmic paper as a function of the feed. As shown in Fig. 11, they approximate so closely straight lines that it is quite probable that the slight variations from a straight line, which are in no case more than three per cent, represent unavoidable errors in calculation, which were carried only to the nearest foot in cutting speed, or the nearest tenth of a minute.

Even these calculations are more precise than are usually practicable in ordinary shop practice. To indicate the degree of correlation between the actual and calculated values, the total costs have been calculated from the formulas, and plotted in dotted lines in Curves 3, 7 and 10. It will be seen that the calculated values fall almost exactly on the original curve, so that it is reasonably certain that the computed curve can be used to represent the true values as an extrapolition. Some further calculations have been made which seem to indicate that the exponent of the feed in the equation:

$$\text{Total cost} = \text{fixed cost} + \frac{\text{constant}}{(\text{feed})^n}$$

is nearly, if not quite independent of any tool life between grinds which may have been assumed. Illustrations 1 and 2 would seem to indicate that tool size had little effect. It is believed that an exponent $n = 0.44$ can be used with substantial accuracy for all engine lathe or screw machine operations when cutting steel with high-speed steel tools.

In view of the close correspondence between the results obtained with different sizes and shapes of tools, and with different tool lives under cut, when cutting steel with high-speed steel tools, it was believed that a single simple illustration would be ample when investigating the cutting of cast iron with high-speed steel tools. The cylinder shown in Fig. 12 was chosen, as the machining involved is entirely rough turning, with a minimum of handling time. The tool shown in Fig. 2 was again used for this work, although it is believed that good shop practice would call for the use of a somewhat larger tool on work of this nature. The contour and angles, which had been deliberately chosen to make the tool avail-

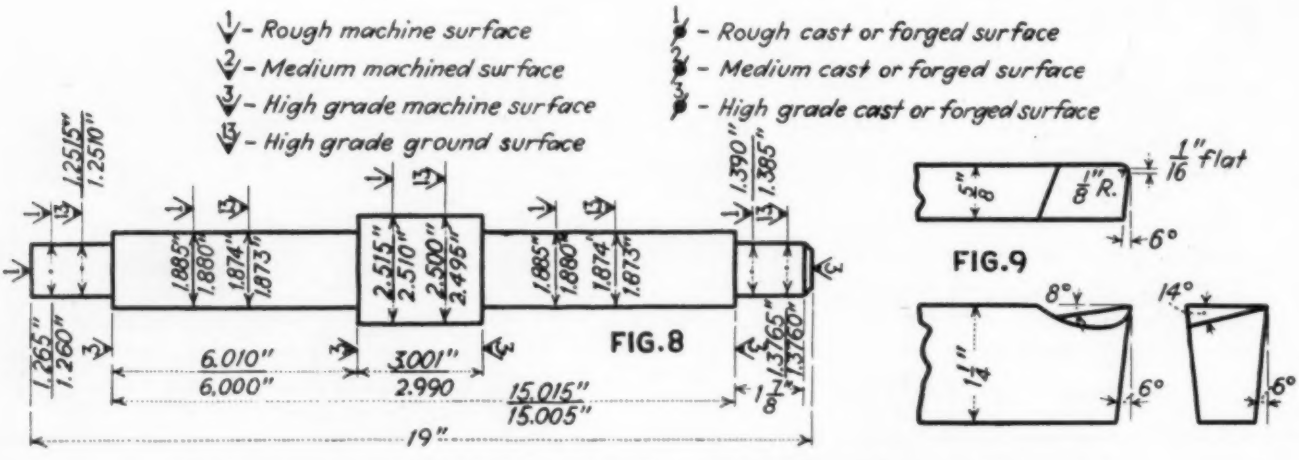


Fig. 8—As an example of hand screw machine work this gear shifter shaft was used.
Fig. 9—A solid tool of the dimensions shown was used for the work in Fig. 8

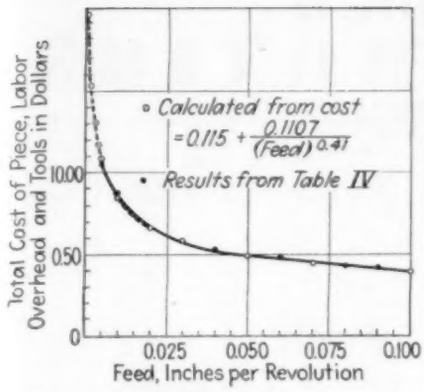


Fig. 10—Relation between total cost and feed on a hand screw machine job

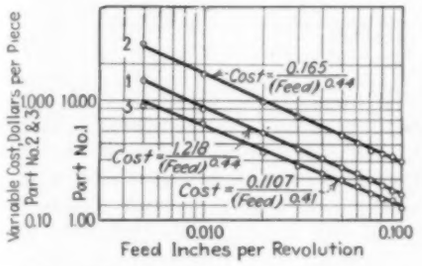


Fig. 11—Plotted on logarithmic paper the curves in Figs. 3, 7 and 10 become straight lines

able for use on any type of work without great loss of efficiency, was believed to be quite suitable for use in cutting cast iron, as well as the harder grades of steel. Only two roughing tools are ordinarily necessary, one for soft steel and one for hard steel and cast iron. This second tool can also be used effectively in turning cast bronze. For soft steel, a tool having a side rake of approximately 22 deg., as recommended by Taylor and Barth, would be somewhat more efficient.

To simplify the calculations, it was assumed that a single cut $\frac{3}{8}$ in. deep was taken, that there was no sand burned on to the surface, and that the casting had no appreciable hard skin. It is realized that usually one or more finishing cuts would be taken on such a job, but it was believed, in view of the small amount of variation shown in the investigation on the turning of steel, that it was unnecessary to consider more than the single cut.

The machining figures were based on some recent data, obtained under practical shop conditions in turning a gray cast iron of approximately 180 Brinell, with a good grade of modern 18-4-1 high-speed steel, hardened at 2400 F, of the size here assumed. While the contour of the test tool was different from that here used, the necessary allowances were made.

The assumptions as to wage and overhead rates and tool cost per grind are the same as those adopted in the first illustration, Table I, as it was considered that such an operation would be performed on a lathe of the same general class, and by a machinist of approximately the same amount of skill, as would be required for the crankpin. The details of the calculation are identical with those previously shown, with only such changes as were necessary because of the change in material cut.

The curve of the total cost plotted against feed, on cartesian coordinate paper, shown in Fig. 13, is obviously similar in form to that previously found in turning steel, Figs. 3, 7 and 10. When the variable portion of the cost is plotted on double logarithmic cross section paper, Fig. 14, it is found that we again obtain practically a straight line, such as was found in Fig. 11, the only difference being that the slope is somewhat steeper, indicating that the variable portion of the cost is inversely proportional to the feed in in. per rev. to the 0.55 power.

It will come as a surprise to many machine shop executives that the cost of machining a particular part should be so directly connected with the feed used. The author's experience has led him to the belief that the majority of machinists, and machine shop executives tend toward the use of a relatively light feed, believing that the increased speed which may be used with such a cut will compensate for its lightness. As can be seen from the four illustrations here presented, this is not the case. The variable portion of the cost varies inversely as the feed to a power which approximates 0.44 in turning steel, and 0.55 in turning cast iron. It is interesting that the relation between these two exponents is the inverse of the relation between the two exponents for the speed-time relation for steel and cast iron. While this may be a fortuitous circumstance, it is believed that there is likely to be some basic relation between the two metals which accounts for this difference.

In turning steel, results were calculated for two sizes of tools, two contours, and three widely differing lengths of tool life without securing differences in the value of this exponent which were not within the range of errors which could be expected from the degree of precision used in making the calculations. It is believed that the following formulas are quite accurate for all cases in which the tool size and shape, depth of cut, and tool life between grinds are held constant, and the cutting speed is adjusted to make it possible to secure the predetermined tool life between grinds:

For high-speed steel tools, cutting steel:

$$\text{Total cost} = \text{cost of handling elements} + \frac{\text{cost of variable elements, 1-in. feed}}{(\text{feed})^{0.44}}$$

For high-speed steel tools cutting cast iron:

Table IV—Total Job Costs for Work Shown in Fig. 8

Figured for the use of feeds from 0.005 to 0.100 in. per rev. in machining steel. Cutting speeds based on 120-min. tool life under cut.

Feed	No. of grinds necessary per piece	Time consumed by machine operator per piece produced, in minutes				Tool grinding time @ 2.6 min. per grind, min.	Cost per piece									
								Direct Labor			Overhead					
		Changing dull tools @ 13.2 min. per change	Handling time	Machining time	Total		Tool Cost	Tool grinding	Lathe operation	Total	Tool grinding	Lathe operation	Total	Total fixed cost (Labor + overhead)	Total variable cost	Total cost
0.005	0.18	2.3	2.9	21.3	26.5	0.5	0.002	0.006	0.265	0.271	0.010	0.773	0.783	0.115	0.941	1.056
0.010	0.13	1.8	2.9	16.1	20.8	0.3	0.001	0.004	0.208	0.212	0.006	0.606	0.666	0.115	0.764	0.879
0.020	0.10	1.4	2.9	12.4	16.7	0.3	0.001	0.004	0.167	0.171	0.006	0.487	0.493	0.115	0.550	0.665
0.030	0.09	1.2	2.9	10.6	14.7	0.2	0.001	0.002	0.147	0.149	0.004	0.428	0.432	0.115	0.467	0.582
0.040	0.08	1.1	2.9	9.6	13.6	0.2	0.001	0.002	0.136	0.138	0.004	0.396	0.400	0.115	0.424	0.539
0.050	0.07	1.0	2.9	8.9	12.8	0.2	0.001	0.002	0.128	0.130	0.004	0.373	0.377	0.115	0.393	0.508
0.060	0.07	0.9	2.9	8.1	11.9	0.2	0.001	0.002	0.119	0.131	0.004	0.347	0.351	0.115	0.368	0.483
0.070	0.06	0.8	2.9	7.6	11.3	0.2	0.001	0.002	0.113	0.115	0.004	0.329	0.333	0.115	0.334	0.449
0.080	0.06	0.8	2.9	7.2	10.9	0.2	0.001	0.002	0.109	0.111	0.004	0.317	0.321	0.115	0.318	0.433
0.090	0.06	0.8	2.9	7.0	10.7	0.2	0.001	0.002	0.107	0.109	0.004	0.312	0.316	0.115	0.311	0.426
0.100	0.05	0.7	2.9	6.5	10.1	0.1	0.000	0.001	0.101	0.102	0.002	0.295	0.297	0.115	0.399	0.284

Tool dimensions.....1x1¼x8 in.
Minimum length of shank.....3 in.
Usable length of shank.....5 in.
Number of dressings per tool.....7

Number of regrindings per dressing.....20
Number of regrindings per tool.....140
Cost of tool.....$1.07
Cost of heat-treatment......25
Total tool cost.....$1.32

Cost of tool per grind.....$0.0094
Direct labor rates, tool grinding.....$0.70
lathe operation.....$0.60
Overhead rates, tool grinding.....$1.20
lathe operation.....$1.75

Table V—Total Job Costs for Work Shown in Fig. 12

Figured for the use of feeds from 0.005 to 0.100 in. per rev. in machining cast iron. Cutting speeds based on 30-min. tool life under cut

Feed	No. of grinds necessary per piece	Time consumed by machine operator per piece produced in minutes				Tool grinding @ 2.6 min. per grind min.	Cost per piece									
								Direct Labor			Overhead					
		Changing dull tools @ 1.7 min. per change	Handling time	Machining time	Total		Tool cost	Tool grinding	Lathe operation	Total	Tool grinding	Lathe operation	Total	Total fixed cost	Total variable cost	Total cost
0.005	21.4	36.4	95.0	643	774	55.6	0.282	0.604	8.38	8.98	1.112	22.58	23.69	3.80	29.15	32.95
0.010	14.8	25.2	95.0	444	564	38.5	0.195	0.417	6.12	6.54	0.770	16.45	17.22	3.80	20.16	23.96
0.020	10.2	17.4	95.0	305	417	26.5	0.135	0.287	4.52	4.81	0.530	12.14	12.67	3.80	13.82	17.62
0.030	8.2	14.0	95.0	245	354	21.3	0.108	0.231	3.83	4.06	0.426	10.32	10.75	3.80	10.89	14.69
0.040	6.9	11.7	95.0	206	313	18.0	0.091	0.195	3.39	3.59	0.360	9.13	9.49	3.80	9.37	13.17
0.050	6.1	10.4	95.0	183	288	15.9	0.081	0.172	3.12	3.29	0.318	8.40	8.72	3.80	8.29	12.09
0.060	5.6	9.5	95.0	167	272	14.6	0.074	0.158	2.95	3.11	0.292	7.93	8.22	3.80	7.60	11.40
0.070	5.1	8.7	95.0	154	258	13.3	0.067	0.144	2.80	2.94	0.266	7.53	7.80	3.80	7.01	10.81
0.080	4.8	8.2	95.0	143	246	12.5	0.063	0.136	2.67	2.81	0.250	7.18	7.43	3.80	6.50	10.30
0.090	4.5	7.7	95.0	134	237	11.7	0.059	0.127	2.57	2.70	0.234	6.91	7.14	3.80	6.10	9.90
0.100	4.2	7.2	95.0	125	227	10.9	0.055	0.118	2.46	2.58	0.218	6.62	6.84	3.80	5.68	9.48

Tool dimensions ..... 1x1¼x14 in.
Minimum length of shank ..... 5 in.
Usable length of shank ..... 9 in.
No. of dressings per tool 10
No. of regrindings per dressing 17
Total number of grinds per tool 170

Cost of tool @ 0.60 per lb $2.00
Cost of heat-treatment $0.25
Total cost of tool $2.25
Cost of tool, per grind $\frac{2.25}{170}$ $0.0132
Time to grind tool ..... 2.6 min.

	Direct labor rate	Overhead rate
Lathe operation	0.65	1.75
Tool grinding	0.70	1.20

$$\text{Total cost} = \text{cost of handling elements} + \frac{\text{cost of variable elements, 1-in. feed}}{(\text{feed})^{0.55}}$$

The cost of the variable elements includes all direct and indirect costs of the time spent in machining, changing tools, grinding tools, dressing tools and the cost of the tool material. It is not practical to operate at a 1-in. feed, or to calculate such a cost directly, but this constant may be obtained by calculating the variable cost at any feed, and then multiplying this cost by the feed used to the appropriate power. With the constant once calculated in this manner, the effect of a change in feed on the cost can be readily calculated.

The curves on cartesian coordinates, Figs. 3, 7, 10 and 13 which are all similar, show that the cost drops rapidly as the feed is increased at first, but that

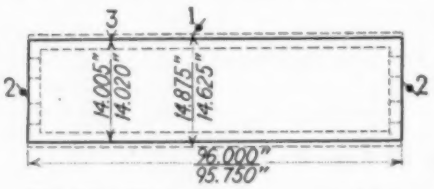


Fig. 12—This cylinder was used to show the effect of feed in rough turning cast iron

the maximum effect from the increase in feed has been secured by the time that a feed of 0.040 in. per rev. has been reached. While the cost continues to drop, the reduction in cost obtained by increasing feed from 0.040 to 0.100 in. when turning steel, is immaterial in comparison with the reduction to be obtained by increasing feed from 0.005 to 0.040 in. When turning cast iron, as might be expected, it is economical to increase feeds up to approximately 0.060 in. Because of the difficulties encountered from springing of the work, weakness of the tool post and the like, it will not ordinarily lower costs sufficiently to make the additional grief worth while to use feeds above 0.040 in. for steel, and 0.060 in. for cast iron, except under unusual circumstances, such as the wide finishing cuts frequently used in machining cast iron.

The same method is entirely applicable to all other machining operations, engine lathe illustrations being used only because of the fact that the data on turning was more complete than that for the other common operations, as well as being the most widely used of all operations. There does not seem to be any reason why any conclusions reached are not equally applicable to all forms of automatic lathes, as well as the simple engine lathe. While there might be some difficulty in applying the method to other operations, such as drilling and milling, because of the lack of available data, it is quite certain that similar results would be found in such cases as well.

All data has been based on the cutting efficiency of the tool used, with no reference to the machine tool employed. Where the work is limited by the machine, it is obvious that the shop cost has thereby been increased, and the desirability of a replacement should be considered. This, of course, does not apply to a single limiting cut but to the type of cuts which form the average run of work for the machine in question. The formulas developed should be of value in considering the advisability of purchasing new equipment. The savings to be effected by increasing the feed to any particular value can be readily calculated, when the cost for any particular set of conditions is known.

The foregoing figures have all been based on the cutting of steel and cast iron with properly hardened high-speed steel tools. Up to the present, no work has been done as to the effect of change in feed when using stellite or carbide tools or when non-ferrous metals are machined. The same method should be used, with the exception that data applicable to the tool material, and to the metal cut, should be used. The interested reader can figure this for himself, using data directly applicable to the shop with which he may be connected.

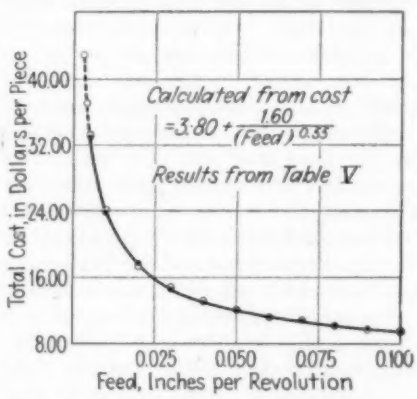


Fig. 13—Relation between total cost and feed on a cast iron turning job

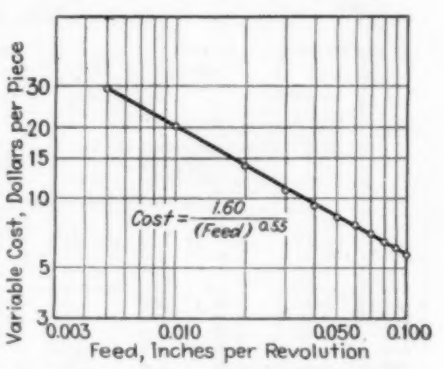


Fig. 14—When the variable costs of turning cast iron, taken from Table V, are plotted on logarithmic paper a straight line is produced

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EDITORS

Exam Time

AS JUNE APPROACHES the thoughts of the younger generation turn apprehensively toward the impending examinations that will determine how well they have mastered their daily tasks, and whether they are fitted to go forward. This year the youngsters are going to have company. It is exam time for the New Dealers, the Brains Trusters, the Administration and all the rest of us who have taken any part in the peaceful revolution of 1933 and 1934. For the professorial Brains Trusters, at least, it should be a novel experience because their usual part has been the setting of examinations, and not the taking of them. Perhaps the rest of us will be forgiven if we watch their struggles to prove the soundness of their theories and the validitiy of their experimental methods, with some measure of satisfaction.

Make no mistake, exam time is really at hand. Labor is not at all satisfied with what the New Deal has provided. The consumer is getting more and more annoyed at what has been done to prices of some commodities. Industry has reversed its former attitude of dazed acceptance, is becoming boldly critical of certain phases of NRA, and is openly opposed to Senator Wagner's Labor Disputes Bill.

We hear more frequently either that the Administration policies and acts are slowing down the return of prosperity, or that they have had little to do with recovery and that we should have had at least as much of a recovery without them. Possibly this very general attitude is typical of the ungratefulness of the human animal, but it seems to us to be a healthy sign that he is again taking a keen and more or less intelligent interest in legislative and administrative acts that affect his interests, rather than submitting supinely to noble experiments that have little to recommend them other than the good intentions of their perpetrators. The analytical statement by the Durable Goods Industries Committee, which is printed on following pages, is typical of the trend.

At any rate the whole New Deal is in for an examination which its originators ought to welcome. Let's weigh the value of the various experiments, accept the successful ones, and reject or reconstruct the failures.

Undesirable Customers

PURCHASES of materials and machinery have been so scarce during the past few years that some of the buyers seem to have forgotten that unfair methods eventually reflect on the whole industry and add to the cost of whatever they buy. Recent reports from automotive centers reflect practices that are costly to all concerned. Bids had been asked and a date given for their opening. Estimates were submitted by several concerns and their salesmen gathered on the date named each hoping, if not expecting, to get the order.

Imagine the chagrin and justifiable exasperation, to put it mildly, when they were told that the contract had been given out several days before. It would be interesting and illuminating to know just how much unnecessary expense this saddled on the industry. Sooner or later this goes back to the purchasers.

It is bad when anxiety to get an order causes the seller to go to unwarranted expense to secure it. But when a purchaser indulges in unfair practices of this kind he joins the list of undesirable customers, whether he knows it or not.

Three Alternatives

AFTER the trying days of the past three years it is little wonder that the average manager is chiefly concerned with the details of the business for which he is responsible. But industry as a whole has a greater responsibility, not only as a civic duty but for its own preservation. The primary concern of all industry is employment for all who are employable.

Society, of which in this country industry is by far the major part, is faced with three alternatives. Men and women must be employed at wages that will provide adequate subsistence and so make a market for the bulk of what we produce, or they must be fed, clothed and housed without employment. The only other alternative is chloroform or lethal gas, for they cannot exist without sustenance, earned or given without work.

In pioneer days men could make their own jobs. Now jobs depend so largely on industry that the average worker cannot find employment outside the factory. Nor is there any turning back to the days of hand labor. Machines have been largely responsible for our advancement and they have come to stay. But the managers of industry must find ways and means of balancing employment, production and distribution with far greater equity than in the past. Failure to make a beginning in this direction is sure to bring more drastic legislation than any that has yet been proposed.

Durable Goods Committee

Accepts Minimum Wage Principle—Favors NRA Control of Pricing—Compares Situation of Durable and Consumer Goods Industries

At the conference of code authorities in Washington, March 5, General Hugh S. Johnson asked that committees be appointed from the durable goods and consumer goods industries to study the "twelve points of complaint." On April 29 the Durable Goods Industries Committee, under the chairmanship of George H. Houston, president of the Baldwin Locomotive Works, made public the following report. It is reprinted in full.

• • • •

The Durable Goods Industries Committee recognizes that the National Industrial Recovery Act is premised on the existence of a national emergency which affects the public welfare. Consequently, these comments are submitted solely with reference to the emergency.

The Committee is of the opinion that because of their close correlation its comments on certain of the twelve points suggested by General Johnson can be more effectively presented if grouped somewhat differently than the numerical order in which they were originally stated. For this reason it is dealing with points 1, 2 and 6 together, also with points 7 and 12 together.

POINT 1. "A more uniform and equitable rule of national price stabilization in those cases where it is necessary to maintain wages at a decent standard against the certain results of predatory and cutthroat competition, and further insurance against increase of price faster and further than increase of purchasing power."

POINT 2. "A more effective rule on costs for the purposes of maintaining rules against sales below costs of production."

POINT 6. "Certainty of protection against monopoly control and oppression of small enterprise, and, especially, the inclusion in codes of adequate buying (as well as selling) provisions to guard against oppression of small business."

A. Minimum Wage For Common Labor

The Committee recognizes that a minimum wage is a subject for consideration from the social rather than the economic point of view. It accepts the principle that, for the present emergency, it is necessary to maintain wages at a decent standard against the certain results of predatory and cutthroat competition.

B. Minimum Prices

Whatever the merits of unrestricted competition may be under ordinary circumstances, experience has shown that some degree of price stabilization in many industries is necessary in an emergency such as the present if wages are to be maintained at a decent level. The form which price stabilization should take, and its extent, however, depends entirely upon the individual characteristics of each industry. No uniform rule can be prescribed which will be effective for all. The most generally recognized method of preventing socially undesirable price cutting is to prohibit sales below cost. This is not, under all circumstances, a complete or appropriate remedy, as is recognized by the existence of other plans of price stabilization which will be described briefly in the paragraphs which follow.

C. Pricing Methods and Their Effect

The use of any pricing method should be permitted when desired by an industry and where it results in any form of price stabilization or control when sanctioned by the Administrator.

Unlimited Competition may be defined as the free and uncontrolled pricing by each enterprise of the products produced by it within a given industry.

In the case of those products which are sold after they have been produced, prices may be fixed in relation to actual ascertained costs.

In the case of those products which are built to special design or customer's specifications and, therefore, are sold before they are produced, the price must be fixed from estimates of costs prepared prior to actual production. Such estimates may or may not be determined pursuant to proper cost formulas.

With either type of product, the extent to which the selling price is related to actual or estimated costs will depend largely upon the competitive situation. In the absence of a rule prohibiting selling below cost, unlimited competition, properly interpreted, does not offer a method of stabilization, except as the establishment of uniform minimum wages and maximum hours may have an influence.

Open Pricing may be defined as the pricing of products by price lists and discounts or by net prices which are published to the trade and which are distributed to competitors either through a central bureau or otherwise.

In some systems prices become effective immediately when published and distributed. In others, it is provided that prices will become effective upon the expiration of a specified waiting period.

Usually prices are made by each company independently, and the stabilizing factor is the knowledge that the uneconomic reduction in prices will not secure for the price cutter any secret competitive advantage.

An essential factor in all open pricing systems is that the prices published shall not be deviated from by the maker until succeeded, at a new effective date, by a new price, likewise published. The net effect is that all buyers and sellers in a given market know what prices are being made and consequently competition is based on knowledge rather than on ignorance. Secrecy is the principal menace to stabilization.

Sometimes the open price system takes the form of distributing information only with respect to past transactions.

The technique that has been built around the open pricing principle varies considerably in different industries, the only point in common being that if such a system is to be effective and at the same time fair, it must be precisely developed with reference to the characteristics of the particular industry and be honestly operated.

Price Fixing may be defined to include any pricing method that involves the fixing of a common or related price for a given product by two or more com-

Answers General Johnson

petitors. This method might involve a limitation on selling below a fixed price, selling above such a price, or on varying from this price either way. An example of price fixing is the establishment of minimum prices under the code of fair competition for the cleaning and dyeing trade.

Allocation is defined to mean a plan by which two or more competitors functioning directly or through a central authority distribute the available business between or among them in accordance with a predetermined program. Such allocation necessarily has a direct effect upon prices even in the absence of other price control.

Resale Price Control is the establishment by a producer of the price at which his customers must resell his products. This may take the form of a minimum price, a maximum price, or a fixed price.

D. General Comments

The Committee does not endorse nor condemn any particular method of pricing or price stabilization.

With the exception of price fixing and unlimited competition which, of course, cannot exist co-extensively, any two or more of these pricing methods may be combined in a given situation.

No one method will satisfy the requirements of all situations, but each industry should be permitted to adopt, develop and use the method best adapted, in its judgment, to its own requirements. However, any pricing method which may raise the price level above that created by free and open competition should be permitted only after full consideration of all the factors involved and with the approval and under the general direction of the N.R.A.

Unlimited competition was the legal method of pricing during the development of industry in the United States. This method of pricing developed abuses and in the present emergency resulted in much cut-throat competition which, until minimum wages were established in codes by law, undoubtedly produced, in many instances, drastic wage reductions as a means of reducing costs.

In the absence of specific need for some other pricing method, unlimited competition should be considered the normal method of pricing of manufactured products, subject however to the establishment in the codes of the industries concerned of such fair-trade practices as may be found desirable.

In order that there may be the required flexibility in the administration of any system of price stabilization, broad discretionary powers should be lodged in code authorities. Government representation on code authorities, adequate statistical reports, the right of appeal, and effective machinery within the N.R.A. for the enforcement of code provisions should be sufficient check upon codified industry to prevent destructive competition on the one hand with its harmful effect upon the wage level, or undue price rise on the other hand with its burden to the consumer.

Purchases by all government departments should be made with full recognition of and in accordance with provisions of codes. Any failure of the government to recognize such provisions or any effort to stipulate conditions inconsistent therewith constitutes a discrimination against private enterprise and is harmful to the spirit of the National Industrial Recovery Act.

In the absence of price fixing it is frequently desirable to establish a minimum level of selling at the point below which prices are uneconomic and unsocial. The most commonly accepted minimum is cost. This cost is sometimes a company's individual cost, sometimes it is the average cost of the industry, or it may be so-called "representative" or "reasonable" cost determined either arbitrarily or with reference to the costs of some members of the industry. Where individual costs are the basis of the rule, there is usually found a provision permitting a company to sell below its own individual cost to meet the prices of a competitor whose costs may be lower.

Whatever cost is used as a basis for the rule, that cost must usually be determined in accordance with a uniform cost formula, which may or may not contain arbitrary determinations of the allowance of some cost factors. While these are the essential characteristics of most provisions against selling below cost, such provisions may take a number of other forms.

No specific rule can be applied effectively and equitably to all industries and much latitude should be given code authorities, subject to the approval of the Administrator, in developing the particular procedure which will be most appropriate.

The sale of products by small enterprises at somewhat lower prices than those established by larger enterprises is recognized in some industries as a means of offsetting the possible advantages of larger enterprises. The committee is of the opinion that this is a matter which must be decided by each industry.

Efficiently operated small companies have little to fear from larger competitors, especially in periods of low sales volume, when the larger mechanized companies usually suffer from heavy overhead charges.

A great menace to small sound enterprises is the competition of border-line or sub-marginal producers, both large and small, manufacturing products of

CALCULATED FROM FIGURES PUBLISHED IN "SURVEY OF CURRENT BUSINESS" ISSUED BY THE U.S. DEP'T. OF COMMERCE

Chart showing relative activity in 1933 as a percentage of 1929 activity, developed during the investigation made by the Durable Goods Industries Committee

identical kind or established design who are usually under-financed, poorly equipped, produce sub-standard products, and who depend upon low wages for their existence. Without proper accounting, in many cases they unwittingly continue what they presume to be profitable operations, when in fact they are chronically consuming their capital.

POINT 3. "Uniformity of wages and hourly rates in competitive industries."

The necessity of effecting uniformity of wages and hourly rates in competitive industries depends somewhat upon the extent to which the competitive industries are mechanized. As opportunity offers, and where desired by code authorities of industries concerned, minimum wage rates in competitive industries should be adjusted to obtain such a degree of uniformity as may be fair to the competitive industries. Adjustments should be effected only after full study and consideration of the facts. No rigid formula is practicable.

POINT 4. "Uniform classification of areas for the purpose of the North-South differentials."

The propriety of North-South differentials varies with different industries. The geographical distribution of plants in different industries where such differentials may be justified is so diverse that no attempt should be made to establish a uniform classification of areas. The question of North-South wage differentials should be considered solely on its merits with respect to each individual industry. The availability of power and raw material, proximity of markets, the character and relative value of products, and the comparative strength, size and mechanization of companies are all determining factors.

Table I—Average Earnings per Hour

	July, 1929	Feb., 1933	Feb., 1934	Feb., 1933 Percentage of July, 1929	Feb., 1934 Percentage of July, 1929
Unskilled workers.....	45.9c.	40.0c.	44.5c.	87.1	96.9
All others	62.8c.	53.4c.	59.4c.	85.0	94.6

Table II—Average Hours Worked per Week

	July, 1929	Feb., 1933	Feb., 1934	Feb., 1933 Percentage of July, 1929	Feb., 1934 Percentage of July, 1929
Wage employees.....	49.5 hrs.	32.2 hrs.	34.6 hrs.	65.0	70.0
Salaried employees...	44.0 hrs.	39.7 hrs.	39.0 hrs.	90.4	88.6

POINT 5. "Further reductions in hours per week and further increase in hourly wages."

In order to secure reliable information on this important suggestion a questionnaire was sent to the durable goods industries.

The industries' data are based on reports from 2,275 individual companies on finances and 2,672 companies on wages and hours. These companies are parts of 83 different industry groups.

The data collected from the industries show that the Durable Goods Industries in February, 1933, employed 44.3% and in February, 1934, employed 60.2% of the number employed in July, 1929. These figures are almost exactly the same as those shown by the Bureau of Labor Statistics for the Durable Goods Industries. The tables used in this discussion have been prepared from the industries' figures, except as otherwise noted.

Because of code provisions, the President's Reemployment Agreement, and wage advances, substantial changes have been made in the wages paid and hours worked in the Durable Goods Industries during the past year.

Table I shows the changes in wage rates during the periods indicated.

As may be seen from Table I the average earnings per hour of employees in the durable goods industries in February, 1933, were from 12% to 15% below the 1929 level. The increase in wages during the last year has raised the average hourly earnings to the point where, in February, 1934 they averaged only 3% to 5½% less than in 1929. Some substantial wage advances have been made since February, so that the average hourly earnings in the Durable Goods Industries today would probably be substantially the same as they were in 1929.

In almost all the industries the codes provide for a 40c. minimum hourly rate, with some territorial and population differentials below 40c. Only a few codes stipulate minimum rates in excess of 40c. per hour.

Many codes prohibit sales below cost. In no report received by the committee does industry believe that an increase in cost would be absorbed by the industry. This statement is supported by the fact that the Durable Goods Industries as a whole are still showing financial losses in today's operations.

Most of the codes under which the Durable Goods Industries are operating provide for a normal maximum of 40 hours per week with varying provisions for flexibility.

The average work week of employees of the industries is shown by Table II.

The industries reported normal work weeks in 1929 varying from 39 to 56.5 hours, but the average hours actually worked per week in July, 1929, were 49.5. The February, 1934, average of 34.6 hours per week for wage employees represents a reduction of about 30% from the average of 49.5 hours actually worked in 1929. The reduction in hours of salaried employees from 44.0 per week in July, 1929, to 39.0 per week in February, 1934, has been 11.4%.

A decided shortage of skilled labor is reported in some industries and in some localities. The long continued depression in the Durable Goods Industries has practically precluded training younger employees to fill positions requiring special skill. At the same time many former skilled employees have become unemployable because of age or unavailable because of migration to other occupations or districts or through death.

If business improves, a scarcity of skilled labor may actually cause an acute

***Straight-Line Manufacture of Freight Cars*—A glimpse of the assembly track in the Altoona Works, Pennsylvania R.R., where 7,000 all-steel freight cars are being built as part of the employment and improvement program financed by PWA. The operation is construction of the steel underframe**

Table III—Weekly Income

	July, 1929	Feb., 1933	Feb., 1934	Percent. Increase Feb., 1933 to Feb., 1934	Percent. Decrease July, 1929 to Feb., 1934
Unskilled workers.....	$22.72	$12.88	$15.40	19.6	32.2
All others.....	$31.9	$17.19	$20.55	19.5	33.9

Table IV—Weekly Income in Dollars Corrected by Changes in Cost of Living Index

(Base: July, 1929 = 100)

	July, 1929	Feb., 1933	Feb., 1934	Increases Feb., 1933 Feb., 1934	Decreases July, 1929 Feb., 1934
Lowest paid wage employees..	$22.72	$17.86	$19.67	10.1%	13.4%
Other wage employees.....	31.09	23.84	28.25	10.1%	15.6%

stoppage of progress in reemployment.

The industries report that less than 10% of the shop operations are necessarily continuous. They report, also that more than 70% of the output is manufactured on individual orders received from customers and not for stock. Thus, to avoid hiring a large number of employees when orders are received and dismissing them when orders are completed, flexibility in working hours is required in excess of the flexibility in an industry where the products are manufactured for stock.

Of more significance to the employee than the average rate per hour is the total weekly income.

Table III, which is compiled from industries data, compares the present average weekly earnings of employees in the Durable Goods Industries with their earnings in 1933 and 1929.

The individual is interested in what the wages will buy rather than the wages in dollars.

Using July, 1929, as a base equal to 100, the National Industrial Conference Board cost of living index for February, 1933, is 72.1 and the index for February, 1934, is 78.3. It is consequently possible to adjust the foregoing Table III and express "Weekly Income In Dollars" on a more truly comparative basis.

Due to shorter working hours, weekly earnings have diminished since 1929, but there has been an accompanying reduction in the cost of living. When this fact is taken into consideration it is apparent that weekly earnings have really been reduced by only 15% since 1929 instead of 33%.

There have been some substantial wage advances since February, 1934, which are not taken into account in this report.

The tabulated financial figures of 2,275 companies replying to the committee's questionnaire show conclusively the inability of the Durable Goods Industries to absorb increased costs, including the maintaining of employment not justified by sales. The following tabulation shows how critical the situation is:

Table V—Financial and Sales Data

Total assets end of 1933	72.0% of 1929
Surplus end of 1933.....	55.3% of 1929
Sales 1933	32.8% of 1929
Sales 1934 (2 mos. average)	35.2% of 1929

The decline in the building industry was even more striking:

Value of Residential Construction in 1933.....	12.5% of 1929

The trend of sales is slightly upward. The number of employees added and the wage increases are substantially in excess of the sales trend.

The Durable Goods Industries as a whole have operated at a loss in 1932 and 1933. Many of the companies have sustained heavy losses for an even longer period.

Table VI—Profit or Loss in Per Cent of Sales

1929	11.8% profit
1932	18.3% loss
1933	6.3% loss

The seriousness of these losses is accentuated by the fact that even under the most favorable circumstances the profit on the investment has not been large, because of the low rate of turnover. In 1929, one of our best years, the total sales reported were only 93% of the total assets. It is evident from this that the Durable Goods Industries turn over their capital less than once a year.

The shrinkage of 28% in total assets and 44.7% in the surplus of the industries is mainly in cash, receivables and inventory; in other words, essential working capital. What remains is, for the most part, fixed assets such as land, buildings and equipment, already partly obsolete, which are largely non-liquid, are salable only at depreciated values, and simply represent an overhead expense. This means that these companies, if they continue unprofitable operations, will suffer financial catastrophe and cease to be taxpayers and employers of labor.

Hence, any increase in wages or any increase in the cost of material must be passed on to the buyer of the product.

The committee believes that any further general increase in wages at this time would retard and not encourage recovery. It is the committee's firm belief that in the Durable Goods Industries, where purchases can be postponed indefinitely, further increases in costs and resultant increased selling prices would tend to reduce the volume of sales and employment.

On the other hand, the committee recognizes that there are individual cases where adjustments have not been made in keeping with industrial adjustments generally, and where special conditions make wage increases and reduction in maximum hours possible. The committee recommends in such

• INDUSTRIAL REVIEW •

• Marking time with its eyes turned toward Washington, the machinery industry awaits further restoration of confidence before it can make its full contribution to that revival of capital goods activity deemed so essential for a general reduction in unemployment. The great backlog of deferred replacement, still scarcely touched, looms as a potential market with enticing possibilities. But pieces of pending legislation, the Wagner labor bill in particular, produce apprehension. Perhaps the adjournment of Congress will help.

• Some sections still show improvement, but hesitation and recession predominate. A bulge in New England, caused mostly by increased lathe prices, contributed to a new peak in April. An encouraging feature was the diversity of industries participating in the purchases. New York, on the contrary, found April below March in machine sales. Philadelphia is unchanged.

• With the gas station strike as the last straw, public sentiment in Cleveland showed a reversal and labor trouble seems to be waning. Cleveland machine tool plants had an April employment increase of 13 per cent, but auomotive suppliers showed some slackening.

• With steel mills busy and machine sales at a peak, Pittsburgh reports progress though the tendency to defer long commitments still remains. Except for a flurry in lathe orders caused by a step-up in prices, Cincinnati has slowed up. Detroit is off about a third from the peak and looks for little change until late summer when model changes should stimulate renewed buying. Present business is mostly in small tools and specialties.

• Chicago is pleased with the diversification and volume of new orders. On the other hand, Milwaukee lost ground in April both in orders and inquiries. In St. Louis, small tools and die shops are still active, but machine demand is limited to single items only.

cases that such changes be made. *In the opinion of the Committee no attempt should be made to effect blanket increases in wages or reduction in code hours by executive order.*

POINT 7. "A much improved method for securing prompt and effective compliance."

POINT 12. "Wider use of mechanism for settling labor disputes in connection with the Code Administration."

A. General Statement

Ground, buildings and machinery are inanimate objects that are of value to our citizens, only when they are used and controlled under the direction of fair-minded, far-seeing, and efficient management. Efficient management has always recognized, that if for no other reason than selfish interest, it was and is good business to adopt and practice such policies as would bring about a condition of mutual confidence and create a spirit of sympathy and of real cooperation between the working organization and the supervisory force.

The first plank in the platform of satisfactory employee-employer relationship is a wage schedule which compensates the worker fairly and generously within the ability of the employer to pay. It would be manifestly unfair to the worker to establish a wage schedule that would stop the purchase of the goods, upon the sale of which his employment depends. A high hourly rate of pay and no hours of work will not put food in the cupboard.

The second plank contemplates the establishment of safe and satisfactory working conditions. Employees do their best work when they are happy and feel safe in their environment.

The third plank of the platform has to do with confidence as it is affected by factors other than planks one and two. Confidence building starts outside the gates and in the community. Management in the major portion of American industry has been a strong advocate of those things in the community which make for better homes, better educational facilities, and all that goes to make up a healthful community life.

We urge that emphasis be placed on and encouragement be given to plans of plant employer-employee contact. If this is done we believe the result will be peace and cooperation through confidence built upon a foundation of understanding.

B. Compliance

The problem of compliance is divided into two parts:

(a) Compliance in reference to fair trade practices.

Note: Complaint by an employer as to compliance of another with respect to hours, wages and working conditions is interpreted as fair trade practice subject matter.

(b) Compliance in reference to hours, wages, and all code provisions that refer to labor, including complaints which involve alleged violations of Section 7A of N.I.R.A., but do not lead to labor disputes.

Note: Labor disputes or such violations of Section 7A of the N.I.R.A. as create or may lead to a strike or lock-out also involve compliance, but should be handled by the use of mechanism for settling labor disputes in connection with Code Administration.

It is recommended that Code Authorities shall provide the necessary machinery to effect compliance under (a) and (b) and that each code authority shall be charged with the responsibility of doing so and clothed with sufficient power to make investigation to this end if not so charged and clothed by its code.

Trade Practice Complaints

It is recommended that when an industry or any sub-division desires to effect contractual relations regarding compliance with reference to fair trade practices among the members thereof "as members of a Code," such provisions be made effective among such members as assent thereto as will permit of this development within an industry, including provisions for appropriate penalties for violations of the provisions of Codes.

Actual Court proceedings should be initiated by the Administrator only. We do not approve of placing the power in the Code Authorities of registering cases of non-compliance with the District Attorney or other prosecuting officer.

It is further suggested that prompt action on the part of the Compliance Division of the N.R.A. through the necessary machinery within the N.R.A. for quick review and reference of complaints which shall be reported to the N.R.A. by Code Authorities, should possibly be extended to include the establishment of Boards of Adjudication for handling trade practice violations of Codes.

Labor Complaints

It is recommended that complaints arising out of labor provisions of a code which may be filed with any authority shall first be referred to the Code Authority for settlement, where such Code Authority has provided the necessary machinery for dealing therewith. Upon the inability of Code Authority to effect such compliance, such complaints shall then be referred by it to the Administrator for action within the Compliance Division of N.R.A.

It is recommended that notices be posted by the Code Authorities in all plants outlining the procedure to be followed in filing complaints with respect to compliance with the labor provisions of any code. The promptest action on complaints will be obtained by filing them directly with the respective Code Authorities concerned.

Since Office Order No. 81, issued March 30, 1934, by the Administrator for Industrial Recovery provides for the appointment of labor advisers to the Administration members of Code Authorities, we feel that ample safeguards for all interests with respect to labor complaints are assured, if the final adjudication of such complaints (i.e. allegations of violation of the labor provisions of the Code not involving labor disputes) be lodged in the Code Authority.

Labor Disputes

In expressing opinions and recommendations with respect to wider use of mechanism for settling labor disputes it is necessary first to establish the principles and policies upon which the machinery for handling the dispute or disputes is based. Such principles and policies are as follows:

1. Every encouragement should be given to the establishment of procedure which provides for the settlement of disputes in a plant by the employees and the management of that plant, since it is axiomatic that labor disputes should be settled at their point of origin.
2. It is our recommendation that each Code Authority be encouraged to set up a plan providing for the amicable settlement of disputes arising within the industry which have not been settled within the individual plant.
3. It is our firm conviction that all subsequent procedure in connection with the handling of disputes should be kept within the jurisdiction of the N.R.A.

The entire recovery program contemplates the cooperation of industry under Codes with the N.R.A. Real cooperation can only be secured when confidence has been established through understanding. Such machinery for handling disputes, as the present National Labor Board or the proposed board of the pending Wagner Labor Disputes Act encourages disputes and prevents the proper handling of employee and employer relationships by driving a wedge between codified industry and N.R.A. with respect to a problem that we believe can best be solved under the jurisdiction of N.R.A. with industry cooperation.

When labor disputes arise (including allegations of violations of Section 7A of N.I.R.A. which may lead to a labor dispute and including actual or threatened strikes or lock-outs), we recommend for the adjustment of such disputes that machinery be set up in each industry in consonance with Part III of Bulletin No. 7 of the N.R.A.

The attention of Code Authorities should be directed to a quotation from page 23 of Bulletin No. 7, "Insofar as this part of the Manual refers to the organization of Industrial Adjustment Agencies and the routing of complaints among them, what is set forth here is merely one possible procedure. Industries will differ in their needs and will be free to propose plans suited to their individual requirements."

POINT 8. "A safe method of financing code administration without racketeering and abuse."

The reasonable expense of code administration should be prorated among and paid by all members of an industry.

All expenditures by code authorities should be based upon proper budgets and be verified by periodic audits. All budgets and audits should be a part of the permanent records of the code authority and should be available to the N.R.A. for review at all reasonable times.

The right of appeal to the N.R.A. as to the amount of assessment or the method of proration should not be denied to any member of the industry. In the event of such appeal, the N.R.A. should have the right to suspend action in the matter of the assessment against such appellant for a limited specified time pending investigation.

The N.R.A., when requested by a code authority, should render such assistance as is within its power in the collection of proper assessments. Failure to pay code assessments should be made a violation of the code.

POINT 9. "Elimination of inconsistent or conflicting provisions among various codes."

Careful code definitions of the industries involved will eliminate most conflicts between codes. Where unavoidable conflicts or overlaps exist in code definitions and code provisions which interfere with smooth and amicable operation under two or more codes, the differences should be composed by agreement between and among the code authorities concerned subject to the approval of the N.R.A.

POINT 10. "Adequate labor and consumer representation in an advisory capacity on code authorities."

Adequate labor and consumer representation in an advisory capacity on code authorities is provided for by N.R.A. Office Order No. 81.

The committee does not approve of direct labor and consumer representation on code authorities.

POINT 11. "Uniformity of governmental representation on code authorities."

The great diversity of conditions in the codified industries prevents uniformity of governmental representation on code authorities.

Metal-Working Code Hearings Scheduled

Date	Place	Deputy Administrator	Association
May 9	Willard Hotel	L. S. Horner	†Fly Swatter Manufacturers
May 10	Raleigh Hotel	L. S. Horner	†Pipe Tool Manufacturers
May 10	Raleigh Hotel	L. S. Horner	Vise Manufacturers
May 10	Carlton Hotel	L. J. Martin	Machinery & Allied Products Institute (Temporary Basic Code Authority)
May 10	Carlton Hotel	L. J. Martin	‡Gas Powered Industrial Truck
May 10	Carlton Hotel	L. J. Martin	‡Pulp & Paper Machinery Association
May 10	Carlton Hotel	L. J. Martin	‡Multiple-V Belt Drive Association
May 10	Carlton Hotel	L. J. Martin	‡Mechanical Press Builders Association
May 15	Washington Hotel	R. W. Murray	Commercial Refrigerator (Amendments)
May 18	Carlton Hotel	L. S. Horner	†Electroplating & Metal Polishing and Finishing Association

†Division of Fabricated Metal Products Federation.
‡Subdivision of Machinery & Allied Products Institute.

Exports of Machinery During March, 1934

	March 1934	Feb. 1934	March 1933
Electrical machinery and apparatus	$5,593,785	$4,295,618	$2,732,276
Power generating machinery (except automotive and electric)	400,933	365,395	263,648
Construction and conveying machinery	443,264	407,661	174,404
Mining, well and pumping machinery	1,717,902	1,393,850	955,292
Power-driven metal-working machinery	1,996,535	1,705,183	681,914
Other metal-working machinery	257,976	131,965	99,946
Textile machinery	682,485	704,855	302,274

Exports of Metal-Working Machinery During March, 1934

	March 1934	Feb. 1934	March 1933
Engine lathes	$94,770	$110,341	$33,570
Turret lathes	28,393	66,376	758
Other lathes	49,702	52,997	9,912
Vertical boring mills and chucking machines	73,547	48,493	8,578
Thread-cutting and automatic screw machines	92,525	57,791	41,723
Knee and column type milling machines	67,882	40,198	37,020
Other milling machines	144,334	142,016	75,104
Gear cutting machines	181,330	186,916	64,538
Vertical drilling machines	47,310	25,222	2,204
Radial drilling machines	290	35,516	.....
Other drilling machines	54,041	65,524	10,652
Planers and shapers	40,534	5,383	2,150
Surface grinding machines	16,605	55,075	15,146
External cylindrical grinding machines	151,039	102,238	3,474
Internal grinding machines	104,584	128,724	11,071
Tool grinding, cutter grinding, and universal grinding machines	29,942	71,094	11,736
Other metal-grinding machines	50,122	55,610	17,611
Sheet and plate metal-working machines	368,640	153,723	93,191
Forging machinery	25,103	45,118	54,357
Rolling mill machinery	28,103	17,538	4,052
Foundry and molding equipment	39,340	31,098	15,737
Other power-driven metal-working machinery and parts	308,399	208,192	169,330

Other Metal-Working Machinery

Pneumatic portable tools	41,849	40,895	13,382
Other portable and hand or foot operated metal-working machines and parts	50,128	32,060	25,393
Chucks for machine tools	10,980	5,904	2,793
Machine operated pipe and thread cutters, stocks, dies, taps and other machine-operated tools	134,622	30,874	30,609
Other metal-working machine tools	20 397	22,232	27,769

U.S.C. of C. Assays the New Deal

Called together to weigh the value of the New Deal, business men of the country turned out in large numbers for the annual meeting of the Chamber of Commerce of the United States in Washington, May 1-5. Those present heard strong approval of much of the plan expressed by speakers on the first day of the meeting, equally strong disapproval by the speakers on the second day's program. They were urged by President Roosevelt to stop crying "Wolf, wolf." They were told by General Johnson that he was not relying on penalties but would start a drive within 60 days to revive interest in NRA, and by W. A. Harriman that very few groups that had codes would give them up voluntarily. They heard Silas Strawn present the view of the conservatives with ability, and re-elected Henry I. Harriman, a liberal, as president. The plight of the durable goods industries was depicted by such speakers as R. E. Flanders (see page 344), Malcolm Muir and George H. Houston.

D. S. Jacobus Elected Head of Welding Society

Dr. D. S. Jacobus, advisory engineer, the Babcock & Wilcox Co., was elected president of the American Welding Society at its fifteenth annual meeting, April 26. Other officers elected were: Senior vice-president, J. J. Crowe, engineer in charge of research and development, the Air Reduction Sales Co.; treasurer, C. A. McCune, consulting engineer; and secretary, Miss M. M. Kelly.

John Christensen Elected A.G.M.A. President

At the eighteenth annual meeting of the American Gear Manufacturers Association, held at Wilkinsburg, Pa., May 3, 4 and 5, John Christensen, president of the Cincinnati Gear Works, was elected president and A. A. Ross, of the General Electric Co., was elected vice-president. J. H. Jackson, of the Pittsburgh Gear & Machine Co., and J. C. McQuiston were re-elected to the offices of treasurer and manager-secretary respectively.

E. P. Connell, of the Falk Corporation, and Howard Dingle, of the Cleveland Worm & Gear Co. were made new members of the A.G.M.A. executive committee. E. W. Miller, of the Fellows Gear Shaper Co., retiring president of the association, and E. S. Sawtelle of the Tool Steel Gear & Pinion Co. were re-elected to the committee for three-year terms.

Ralph E. Flanders, of the Jones & Lamson Machine Co., as guest speaker at the annual dinner, defended the profit motive in business as a constructive force when properly guarded against parasitic speculative elements. Another guest, Prof. F. A. Firestone, of the University of Michigan presented an illuminating address and demonstration on "Noise Measurement of Gears." Prof. C. L. VanSickle, of the University of Pittsburgh, described the machine-hour rate as applied to cost accounting.

Heads A.G.M.A.

JOHN CHRISTENSEN

The membership is now double its low point. Company members admitted were Link Belt Co. and Bilgram Gear & Machine Works. New affiliate members are the Indiana Gear Works, the New Jersey Gear & Manufacturing Co., the Abart Gear & Machine Co,. J. Morrison Gilmour, Moore Gear & Manufacturing Co., Hartford Special Machinery Co., and the Precision Gear & Machine Co.

Cincinnati Milling Machine Company Elects Officers

At the annual meeting of the stockholders of the Cincinnati Milling Machine Company, held on April 24th, the following directors were elected: Dr. O. P. Geier, Walter H. Geier, Walter W. Tangeman, S. Einstein and George Schiele. Subsequently, the board met and elected P. O. Geier, chairman of the board; Frederick V. Geier, president, to succeed his father, the late Frederick A. Geier; Walter W. Tangeman, vice-president; P. O. Geier, treasurer; and Ferris M. Angevin, secretary.

Chairman

P. O. GEIER

President

FREDERICK V. GEIER

• PERSONALS •

W. E. SYKES of the Farrel-Birmingham Co., will be presented with the Edward Longstreth medal by the Franklin Institute on May 16 in recognition of his development of the continuous herringbone gear.

R. B. MILDON has been elected vice-president of the Westinghouse Electric & Mfg. Co. He will have charge of marketing, engineering, manufacturing and service at the South Philadelphia Works.

EDGAR N. DOLLIN, formerly president of the Allied Die-Casting Co. and the Acme Die-Casting Corp., has been appointed manager of the commercial die-casting division of the American Type Founders Sales Corp.

C. M. HAMERSLEY has been made vice-president and general manager of the Calco Machinery Co., Philadelphia, machine tool dealers, succeeding the late JAMES C. CARLTON.

GEORGE SWANSON, formerly superintendent of the Dem Corp., Jamestown, N. Y., has been appointed superintendent of the Two-Way Shock Absorber Co., Jamestown.

• MEETINGS •

THE AMERICAN ELECTRO-PLATERS' SOCIETY. Convention, June 11-14, Statler Hotel, Detroit, Mich. T. C. EICHSTAEDT, secretary, Statler Hotel, Detroit.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Petroleum meeting, May 14-17. Tulsa Hotel, Tulsa, Okla. HAROLD ATKINSON, secretary, Tulsa Bldg. Summer meeting, June 25. Cosmopolitan Hotel, Denver, Colo. CALVIN W. RICE, secretary, 29 West 39th St., New York, N. Y.

AMERICAN SOCIETY FOR TESTING MATERIALS. Annual meeting, June 25-29. Chalfonte-Haddon Hall, Atlantic City, N. J. A. E. Hess, assistant secretary, 260 South Broad St., Philadelphia, Pa.

AMERICAN SUPPLY & MACHINERY MANUFACTURERS ASSOCIATION. Convention. May 22-23. Netherland Plaza Hotel, Cincinnati. R. KENNEDY HANSON, secretary, 604 American Bank Bldg., Pittsburgh, Pa.

MACHINERY & ALLIED PRODUCTS INSTITUTE. May 14-15. Hotel Cleveland, Cleveland, Ohio. John W. O'Leary, managing director, 221 N. La Salle St., Chicago.

SOCIETY OF AUTOMOTIVE ENGINEERS. Summer meeting, June 17-22. Saranac Inn, Saranac Lake, N. Y. JOHN A. C. WARNER, secretary, 29 West 39th St., New York, N. Y.

American Machinist

REFERENCE BOOK SHEET ©

Sizes of Standard Milling Cutters—I

Simplified Practice Recommendation R36-34, Milling Cutters. Recommended by Bureau of Standards. Effective April 15, 1934.

Plain Milling Cutters—Light Duty

[Carbon and high-speed steel. Cutters of less than ¾-in. face have straight teeth; ¾ in. and over, spiral teeth. Helix angle, 25 deg. or under. Hand of spiral optional with manufacturer, but only one style is to be listed.]

Diameter	Width of Face	Size of Hole	Diameter	Width of Face	Size of Hole	Diameter	Width of Face	Size of Hole
2¼	½	⅞	3	3/16	1	4	¼	1
2¼	1	⅞	3	¼	1	4	¼	1¼
2½	3/16	1	3	3/16	1	4	3/16	1
2½	¼	1	3	3/8	1	4	¼	1¼
2½	3/16	1	3	3/8	1¼	4	3/8	1
2½	3/8	1	3	½	1¼	4	3/8	1¼
2½	7/16	1	3	½	1¼	4	½	1¼
2½	½	1	3	5/8	1¼	4	5/8	1¼
2½	5/8	1	3	¾	1¼	4	¾	1¼
2½	¾	1	3	⅞	1¼	4	1	1¼
2½	1	1	3	1	1¼	4	1½	1¼
2½	1½	1	3	1¼	1¼	4	2	1¼
2½	2	1	3	1½	1¼	4	3	1¼
2½	2½	1	3	2	1¼	4	4	1¼
2½	3	1	3	3	1¼			

Plain Milling Cutters—Heavy Duty

[High-speed steel. Helix angle not less than 25 deg. or greater than 45 deg. Hand of spiral optional with manufacturer.]

Diameter	Width of Face	Size of Hole	Diameter	Width of Face	Size of Hole
2½	2	1	4	2	1½
2½	4	1	4	3	1½
3	2	1¼	4	4	1½
3	2½	1¼	4	6	1½
3	3	1¼	4½	6	2
3	4	1¼	4½	12	2
3	6	1¼			

Helical Plain Milling Cutters

[High-speed steel. Helix angle not less than 45 deg. or greater than 52 deg. Hand of spiral optional with manufacturer, but only one style to be listed.]

Diameter	Width of Face	Size of Hole	Diameter	Width of Face	Size of Hole
3	4	1¼	4	8	1½
3	6	1¼	4	10	1½
4	4	1½	4½	6	2
4	6	1½	4½	12	2

Inserted-Blade Side Milling Cutters

[Inserted-blade cutters are regularly furnished with high-speed steel blades. Carbon-steel blades are special. Side cutters have the blades set straight.]

Diameter	Width of Face	Size of Hole	Diameter	Width of Face	Size of Hole
6	2	1¼	8	2	2
7	2	1¼	9	2	1½
7	2	1¾	10	2	1½
8	2	1½			

Side Milling Cutters

[Carbon and high-speed steel. May be made either light or heavy duty, but only one style is to be listed.]

Diameter	Width of Face	Size of Hole	Diameter	Width of Face	Size of Hole	Diameter	Width of Face	Size of Hole
2	3/16	½	3	½	1	5	⅝	1¼
2	1/16	⅝	4	¼	1	5	¾	1
2	¼	½	4	⅜	1	5	¾	1¼
2	¼	⅝	4	½	1	5	1	1¼
2	3/8	½	4	½	1¼	6	½	1
2	3/8	⅝	4	⅝	1	6	½	1¼
2	½	⅝	4	⅝	1¼	6	⅝	1¼
2½	¼	⅞	4	¾	1	6	¾	1
2½	1/16	⅞	4	¾	1¼	6	¾	1¼
2½	3/8	⅞	4	⅞	1	6	1	1¼
2½	½	⅞	4	⅞	1¼	7	¾	1¼
3	¼	1	4	⅞	1¼	7	⅞	1¼
3	1/16	1	5	½	1	8	¾	1¼
3	3/8	1	5	½	1¼	8	1	1¼
3	½	1	5	⅝	1			

Staggered Tooth Milling Cutters

[High-speed steel. May be made either light or heavy duty, but only one style is to be listed.]

Diameter	Width of Face	Size of Hole	Diameter	Width of Face	Size of Hole	Diameter	Width of Face	Size of Hole
2½	¼	⅞	4	¼	1¼	6	⅜	1¼
2½	1/16	⅞	4	1/16	1¼	6	½	1¼
2½	3/8	⅞	4	3/8	1¼	6	⅝	1¼
2½	½	⅞	4	7/16	1¼	6	¾	1¼
3	1/16	1	4	½	1¼	6	⅞	1¼
3	¼	1	4	⅝	1¼	6	1	1¼
3	5/16	1	4	¾	1¼	8	⅜	1½
3	⅜	1	4	⅞	1¼	8	½	1½
3	½	1¼	5	½	1¼	8	⅝	1½
3	⅝	1¼	5	⅝	1¼	8	¾	1½
3	¾	1¼	5	¾	1¼			

Woodruff Keyseat Cutters—Arbor Type

[Carbon and high-speed steel. These cutters are regularly furnished with staggered teeth and without relief on the side teeth. They are of correct dimensions for Woodruff keys and are regularly furnished with diameters 1/32 in. larger than listed below to allow for sharpening.]

Number of Cutter[1]	Nominal Diameter	Width of Face	Size of Hole	Number of Cutter[1]	Nominal Diameter	Width of Face	Size of Hole
26	2¼	3/16	¾	V	2¾	½	1
27	2¼	¼	¾	30	3½	⅝	1
28	2¼	5/16	¾	31	3½	7/16	1
29	2¼	⅜	¾	32	3½	½	1
R	2¾	¼	1	33	3½	9/16	1
S	2¾	5/16	1	34	3½	⅝	1
T	2¾	⅜	1	35	3½	11/16	1
U	2¾	7/16	1	36	3½	¾	1

[1] Keys and cutters correspond in size and number with the following exceptions:
For Key No. 126, use Cutter No. 26
For Key No. 127, use Cutter No. 27
For Key No. 128, use Cutter No. 28
For Key No. 129, use Cutter No. 29
For Key No. RX, use Cutter No. R
For Key No. SX, use Cutter No. S
For Key No. TX, use Cutter No. T
For Key No. UX, use Cutter No. U
For Key No. VX, use Cutter No. V

American Machinist

REFERENCE BOOK SHEET ©

Sizes of Standard Milling Cutters—II

Simplified Practice Recommendation R36-34, Milling Cutters. Recommended by Bureau of Standards. Effective April 15, 1934.

Half Side Milling Cutters

[High-speed steel. May be made either light or heavy duty, but only one style is to be listed.]

Diameter	Width of Face	Size of Hole	Diameter	Width of Face	Size of Hole
4	3/4	1 1/4	7	3/4	1 1/2
5	3/4	1 1/4	7	1	1 1/2
6	3/4	1 1/4	8	3/4	1 1/2
6	1	1 1/2	8	1	1 1/2

Metal Slitting Saws

[Carbon and high-speed steel. Ground concave for clearance on the sides from the periphery to the hole, or made with a flat hub around the hole. The thickness through the hub is not to exceed the thickness at the cutting edge. Either style is optional with the manufacturer, but only one style is to be listed.]

Diameter	Thickness	Size of Hole	Diameter	Thickness	Size of Hole	Diameter	Thickness	Size of Hole
2 1/2	1/32	7/8	4	1/32	1	5	5/32	1
2 1/2	3/64	7/8	4	3/64	1	5	1/16	1
2 1/2	1/16	7/8	4	1/16	1	6	1/16	1
2 1/2	3/32	7/8	4	3/32	1	6	3/32	1
2 1/2	1/8	7/8	4	1/8	1	6	1/8	1
3	1/32	1	4	5/32	1	6	1/8	1 1/4
3	3/64	1	4	3/16	1	6	3/16	1
3	1/16	1	5	1/16	1	6	1/16	1 1/4
3	3/32	1	5	3/32	1	8	1/8	1
3	1/8	1	5	1/8	1	8	1/8	1 1/4
3	5/32	1	5	1/8	1 1/4	8	3/16	1 1/4

Metal Slitting Saws With Side Chip Clearance

[High-speed steel. These saws can be furnished with either fine or coarse teeth, also in either radial or hooked tooth style. Only one style is to be listed by a manufacturer.]

Diameter	hickness	Size of Hole	Diameter	Thickness	Size of Hole	Diameter	Thickness	Size of Hole
2 1/2	1/16	7/8	4	1/8	1	6	1/16	1
2 1/2	3/32	7/8	4	5/32	1	6	3/32	1
2 1/2	1/8	7/8	4	3/16	1	6	1/8	1
3	1/16	1	5	1/16	1	6	1/8	1 1/4
3	3/32	1	5	3/32	1	6	3/16	1
3	1/8	1	5	1/8	1	6	1/16	1 1/4
3	5/32	1	5	1/8	1 1/4	8	1/8	1
4	1/16	1	5	5/32	1	8	1/8	1 1/4
4	3/32	1	5	3/16	1	8	3/16	1 1/4

Metal Slitting Saws With Staggered Teeth and Side Chip Clearance

[High-speed steel. Side teeth are not cutting teeth.]

Diameter	Thickness	Size of Hole	Diameter	Thickness	Size of Hole	Diameter	Thickness	Size of Hole
3	3/16	1	6	3/16	1	8	3/16	1 1/4
4	3/16	1	6	3/16	1 1/4	8	1/4	1 1/4
5	3/16	1	6	1/4	1	..	..	...
5	1/4	1	6	1/4	1 1/4	..	..	...

Woodruff Keyseat Cutters—Shank Type

[Carbon and high-speed steel. Right-hand cutters are considered standard. All sizes have uniform straight shanks 1/2 in. in diameter, and cutters conform to American Standard as published in A. S. A. Bulletin B-17-F-1930.]

Number of Cutter[1]		Diameter	Thickness	Length Over-all	Number of Cutter[1]		Diameter	Thickness	Length Over-all
American Standard[2]	Old Standard				American Standard[2]	Old Standard			
...	201	1/4	1/16	2 1/16	....	14	1	7/32	2 7/32
...	206	5/16	1/16	2 1/16	....	152	1	3/8	2 3/8
...	207	5/16	3/32	2 3/32	609	16	1 1/8	3/16	2 3/16
...	211	3/8	1/16	2 1/16	807	A	7/8	1/4	2 1/4
...	212	3/8	3/32	2 3/32	808	15	1	1/4	2 1/4
...	213	3/8	1/8	2 1/8	....	17	1 1/8	7/32	2 7/32
204	1	1/2	1/16	2 1/16	809	18	1 1/8	1/4	2 1/4
304	2	1/2	3/32	2 3/32	....	19	1 1/4	3/16	2 3/16
305	4	5/8	3/32	2 3/32	....	20	1 1/4	7/32	2 7/32
404	3	1/2	1/8	2 1/8	810	21	1 1/4	1/4	2 1/4
405	5	5/8	1/8	2 1/8	811	22	1 3/8	1/4	2 1/4
406	7	3/4	1/8	2 1/8	812	24	1 1/2	1/4	2 1/4
505	6	5/8	3/32	2 3/32	1008	B	1	3/16	2 3/16
...	61	5/8	3/16	2 3/16	1009	C	1 1/8	3/16	2 3/16
506	8	3/4	3/32	2 3/32	1010	D	1 1/4	3/16	2 3/16
...	91	3/4	1/4	2 1/4	1011	23	1 3/8	3/16	2 3/16
507	10	7/8	3/32	2 3/32	1012	25	1 1/2	3/16	2 3/16
606	9	3/4	3/16	2 3/16	1210	E	1 1/4	3/8	2 3/8
607	11	7/8	3/16	2 3/16	1211	F	1 3/8	3/8	2 3/8
...	12	7/8	7/32	2 7/32	1212	G	1 1/2	3/8	2 3/8
608	13	1	3/16	2 3/16	....	..	....	....	....

[1]Keys and cutters correspond in size and number with the following exceptions:
For Key No. 121, use Cutter No. A
For Key No. 141, use Cutter No. 15
For Key No. 131, use Cutter No. B
For Key No. 161, use Cutter No. C

[2]The cutter numbers shown under the column headed "American Standard" indicates the nominal key dimension or size cutter: that is, the last two digits give the nominal diameter in 8ths of an inch and the digits preceding the last two give the nominal width in 32nds of an inch. Thus, Cutter No. 204 indicates a size 2 2/32 in. by 4/8 in. or 1/2 in. thick by 1/4 in. in diameter.
Cutter No. 1210 indicates a size 2 3/16 in. thick by 1/4 in. in diameter.

Single Angle Milling Cutters

[Carbon and high-speed steel. Furnished either right or left hand and with an included angle of 45 or 60 deg.]

Diameter	Thickness	Size of Hole
2 1/2	1/2	7/8
2 3/4	1/2	1
3	1/2	1 1/4

Single Angle Milling Cutters With Threaded Hole

[Carbon and high-speed steel. Furnished either right or left hand and with either right or left hand threaded hole. Included angle, 60 deg.]

Diameter	Thickness	Size of Hole	Threads
1 1/4	7/16	3/8	24NF
1 5/8	9/16	1/2	20NF

THE ROUND TABLE

Subsidized Suggestions

"Say, Al, what do you do about suggestions in your shop?"

"Nothing at all. Why?"

"At foremen's meeting last night, Bill Pearce suggested that we invite suggestions from everybody as to savings we could make. It sounded like a good idea so I seconded the motion."

"I think you're wrong, Ed. We've had economy drilled into us for so long that we hate the sound of it."

"That may be, but it's still a virtue; and as Bill said, some man might have a mighty good idea, and if he did it would pay for all the trouble. So I guess we're in for a suggestion week."

"I don't think Williams will favor that campaign. It costs a lot of money for prizes, a lot of hard work and the net results are nil."

"Somebody besides the foremen and bosses has ideas, and we may lose a lot of money by not bringing them out."

"That's true, supposing that somebody already has an idea; but on the other hand, ideas are not thought up on the spur of the moment or under stress."

"What do you mean by that?"

"I mean that men cannot think up ideas just because someone has started a contest. Ideas grow slowly, step by step. When they've full flowered the man doesn't need a contest, he's just got to tell some one."

"I don't think so, but let us get back to the way you handle them, what do you do with suggestions?"

"If anyone in our shop has an idea he brings it to me. The first thing I do is to see whether the idea is any good. Then I try to find out whether it is new or merely an old idea rehashed. The next thing, assuming that it is good, is to find out whether it will work in smoothly with our routine. If it passes all these tests, maybe we'll adopt it and maybe we won't."

"In other words, you discourage suggestions?"

"That's it. I discourage them."

"Is that a good policy, Al?"

"In the long run, I think it is. As I say a good idea will come to the surface anyway. When you offer rewards you get all the old junk in ideas that anyone ever heard of. The suggestor doesn't know whether it will work, and doesn't care. He doesn't know whether it's applicable or not, and likewise doesn't care. It's the number of suggestions offered, not their merit, that seems to count and a few of them have got to strike the prize. I had some big ideas about asking men for ideas but what I found out discouraged me. Now I do my own thinking up of ideas."

"A little bit big head, aren't you, Al?"

"Maybe, but I'm paid for thinking up ideas and my thoughts are all along the lines we use at present.

"I gather from what you say that men seldom, if ever, have ideas."

"So rarely that it's almost true. They have ideas as to how they'd like things to be, and they have ideas about small things, but mainly their ideas are about things they have seen in other shops or heard of and are not ideas at all. I know of one firm that got 2,770 suggestions from its 5,000 employees. Only two were of real merit. A few others were of things that obviously should be done, but were neglected. If the men in your shop, Ed, send in five good suggestions, Williams ought to fire his entire staff."

Is the stimulation of suggestions worth while? How should a man be rewarded for thinking beyond his immediate job?

Discussion

Unions—Horizontal or Vertical?

Theoretically, the essential idea back of trade unionism is ideal, and there is no question but that the standards of living and wages enjoyed by craftsmen throughout the world are higher than they would be at present without comparable development of the trade union system. However, the trouble here, as in any other movement where a group of people get together for any purpose, it is necessary to appoint or elect certain few individuals as officers to speak and act for the group.

The big difficulty throughout the ages has been that, wherever such a delegation of authority or responsibility to the few by the many has taken place, it has been the exception when the few have not ultimately exploited the many for the benefit of the few.

On the basis of entirely legitimate operation, there is no doubt that the so-called "horizontal" or "craft" union will attract a better class of men and in return can do more for this class than the "vertical" or industrial unit. The reason for this is obvious; only under proper supervision, can the quality of the membership be set and maintained at a high standard of competence, and the interests of all members more nearly

approach a mutual basis than they can hope to do where the organization must include all classes of skilled and unskilled workers, whose sole community of interest must be with reference to their immediate employment.

On the other hand, a little thought on the experiences of the past few years of extreme conditions of unemployment will reveal the fact that, after all, the big desire in the hearts of all responsible men, whether they be the most skilled of toolmakers or the most unskilled of common laborers, is the provision of stability of employment for as nearly 100 per cent of the supporting population as possible.

Aside, therefore, from the unfortunate fact that experience has proved that the horizontal union has failed in this emergency, not only because of the limitation of its direct interest in the employed personnel as a whole and the unquestioned exploitation of the members in such unions by the agents and officers of these organizations, whose chief and probably natural inclination is to protect their own jobs if necessary at the expense of their constituents, it would seem that common sense alone would indicate that some sort of organization built upon the "vertical" plan, with its interests solely interlocked with those of the company wherein its membership finds employment is the best calculated to produce the sort of results that all sincere workers and employers desire.

That the so-called "company union," or shop representation plan, organized within the membership of the employed personnel of any company, officered from among its own ranks and cooperating to the full with the company administration is about as practical a setup as can be secured, and one which holds fewer chances for the exploitation of its membership is evidenced by the fact that the old line horizontal or craft union leaders are putting up so strenuous a fight against it. Eliminating as it does to a great extent, the necessity for the levying of heavy dues, initiation fees, fines and assessments to be used for the support of a large group of nonproductive officers and agents, it offers an infinitely more direct contact between the workers and those responsible for their operations than can be secured through any outside interference, while permitting the employee to spend money otherwise diverted into outside channels for purposes of his own.

—D. C. WRIGHT.

Trades, or horizontal, unions appear to have had their day, and the present trend of opinion is toward all-inclusive, or vertical, unions. Cooperation is more desirable than pride in a trade. Often pride of trade forbids a mechanic to do certain work which he is well able to do, with the result that time is wasted until some other person does the work. A prolific cause of such ridiculous conditions is the fact that workers doing one class of work have a slight advantage in the form of better remuneration than the workers at other classes of work.

When merit, as shown by quantity or quality of output in a given time, is allowed to determine who shall do certain kinds of work, all kinds of work will be best equated by the only element that is common to all, which is time, consisting of the duration of the exertion of human energy. The universal application of this method for exchanging work will solve the problems of remuneration for everybody. Unions will continue to be necessary so long as employers make exorbitant profits out of what the workers earn. It is now well known that a prolific cause of business instability and unemployment is the inability of workers to buy the things they have made. In other words, their power to produce is not balanced by their power to consume, and because of that, manufacturers lose indirectly, if not directly.

—L. BROWN,
Montreal, Canada.

Within Reason

I put the matter up to a man I met recently. He is an unskilled laborer but a hard worker nevertheless. His reply is interesting. "If Albert Einstein were to hire me, I'd feel that he had a right to make me do any sort of work he wanted done, regardless of what I might think about it at the moment. On the other hand, if I were ever in a

position to hire Albert Einstein, I don't think I'd order him around. I'd have him do the work I was paying him for and not much else!"

The question depends entirely on cases and has no answer in the abstract. To begin with, isn't it a bit preposterous to suggest paying a man up to $1.25 and $1.75 an hour to mind the baby? The maid will do it for less than that per day. Just as I wouldn't dream of having a doctor I was paying by the hour sit there and discuss the weather with me, I wouldn't think of asking skilled labor to stoop to menial tasks. It's not business sense.

On the other hand, if I did ask, should I be obeyed? I think so—within reason. After all, I would hesitate a long time before going out to sell papers again as I did when I was a kid. I have passed that stage, and I feel that I deserve whatever position I've built up.

—MORRY TANENBAUM.

What Share?

In a pure analytical sense, any industrial enterprise is a business venture in which one or many people are financially interested. Therefore, this interest reverts to the simple transformation of labor and materials into a profit. With this axiom as a concrete basis, it would appear logical that every going concern must of necessity have certain fixed charges that must be liquidated before any profits can be realized. It is generally considered that a return of from six to eight per cent is sufficiently attractive for the average investing class.

Considering industry as one large operating unit, is would not appear illogical that fixed charges as well as dividends must first be taken into account before labor can expect any additional compensation over and above the prescribed hourly rates as applying to the different crafts. It is only when an earned surplus exists that a proportion can be allotted to the workers.

Some may assume that you cannot pay labor too much, advancing the theory that without its helping hand all industry would cease to exist. This idea appears to be sound on the surface, but it has many pitfalls. One of the most outstanding is that all paths lead to the same result, commonly cited as the "vicious circle." This expression is clearly illustrated by the fact that, if a manufacturer should be required to raise the level of wages of his employees, he has two alternatives. First, cut the costs of production by the use of more expensive equipment, or, pass the additional costs on to the consumer in the way of higher prices for his output. The latter immediately reflects on the purchasing power on those originally compensated. If we take the former case where modern devices are the order of the day, these must be depreciated over a period of years and appear as a burden having diminishing effect on the net profits. In studying a problem of this kind it is essential that two factors be carefully kept in mind: first labor must be paid its just due and secondly, the investor must also be adequately protected.

—HAROLD L. WYNN, *Executive Engineer, Pacific Electric Mfg. Corporation.*

· IDEAS ·
FROM PRACTICAL MEN

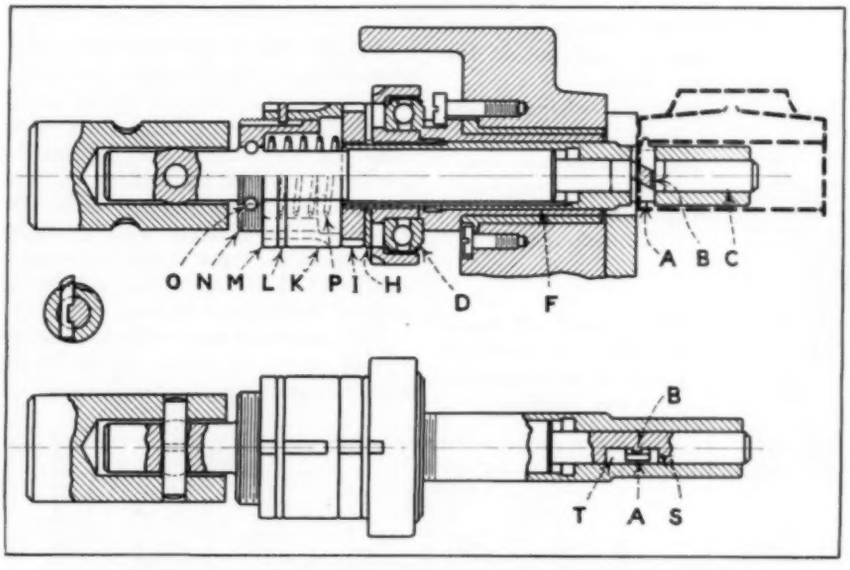
Ring-Grooving Bar for Master Connecting Rods

P. F. ROSSMANN

The bar illustrated was developed for ring-grooving articulated, master connecting rods. The cutter *A* is fed into the work by the angular lug *B* on the driving and feed bar *C* engaging an angular slot in the cutter. The ball thrust-bearing *D* is attached to the pilot sleeve *F*, through which the cutter extends, and is securely held by the washer *H* and the locknut *I*. The amount of feed imparted to the cutter is controlled by the stop collar *K*, which is located by means of washer *L* and locknut *M*. By means of the sleeve *N* and the pin *O*, the parts *L* and *M* are made to revolve with the driving and feed bar.

When the cutter is to be withdrawn, the spring *P* holds the thrust bearing against the locating bushing in the fixture while the driving and feed bar moves upward. The cutter then slides into the pilot sleeve until the surface *S* contacts with the cutter. The entire assembly can then be withdrawn from the fixture.

To permit removal of the cutter for grinding, the adjustable stop collar *K* is backed off so that the surface *T* may be brought close to the cutter. At this point, the lug *B* has traveled beyond the slot in the cutter, releasing the cutter.



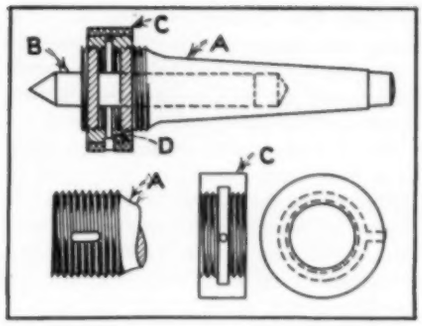
The cutter is fed to the work by traversing the machine spindle, an angular lug on the driving bar engaging an angular slot in the cutter. Depth of cut is controlled by an adjustable stop collar

Sensitive Tailstock Center

N. M. MOORE
Hamilton, Ontario, Canada

In turning work, it grows longer from the heat caused by cutting, and the tailstock center must be backed off from time to time. At such times the center cannot be adjusted with any degree of accuracy without stopping the lathe and testing the tightness of the work by hand.

Recently I made the center illustrated and found that I could adjust it to take care of the inevitable expansion of the work without stopping the lathe. The device consists of the body *A;* the sliding center *B;* the knurled nut *C;* and the pin *D*. The body is fitted to the tailstock spindle, bored for the sliding center, threaded at the outer end for the knurled nut, and slotted to give clearance for the pin. The inside of the nut is recessed to fit the pin.



The sliding center can be adjusted by the knurled nut to take care of expansion as the work becomes heated

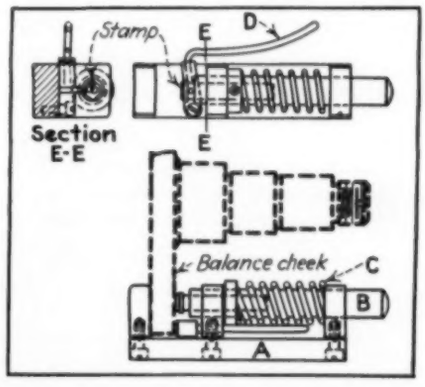
In operation, in starting, the center is adjusted in the usual way. As the work begins to expand, the center is adjusted by turning the knurled nut. The device is sensitive enough to permit the center to be properly adjusted while the lathe is running.

A Stamping Fixture

A. W. DILTS

In the illustration is shown a fixture for stamping identification marks on inspected parts. Primarily, the fixture was designed for the use of a one-armed inspector in stamping his mark on the balance cheeks of crankshafts.

Essentially, the fixture consists of the body *A;* the plunger *B*, in the inner end of which the stamp is held; the spring *C;* and the lever *D*. Grasping the fixture in one hand and pressing the lever against the body, moves the plunger back against the pressure of the spring. The fixture can then be slipped over the balance cheek. When the lever is released, the spring forces the stamp against the cheek with enough pressure



The stamp is automatically held square with the work to be stamped and makes a more even impression than if held by hand

to hold the fixture in position. To stamp the cheek, it is necessary only to strike the outer end of the plunger with a hammer. A soft-faced hammer is used to prevent upsetting the plunger end.

We find that men, even though they have two hands, make a better job of stamping by the use of this fixture, because the stamp is automatically held square with the work, making a more even impression than if it were held by hand.

Setting Tools Accurately Discussion

THEODORE KRUGER

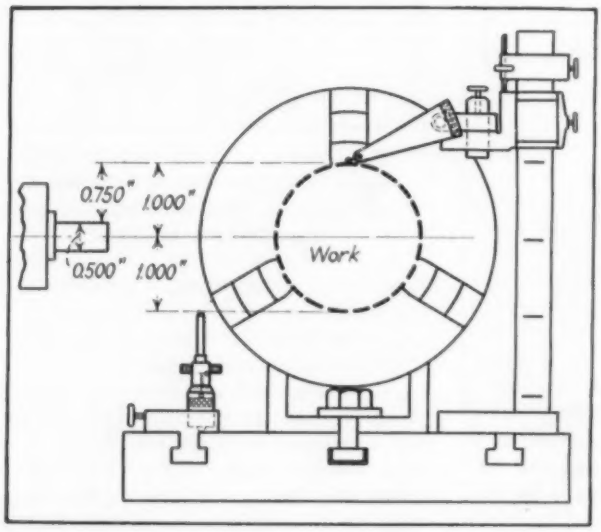
Referring to the article by Peter L. Budwitz, under the title given above, (*AM*—Vol. 77, page 732), it seems as though better results could be obtained by the methods herein described, using standard measuring tools.

Two methods are shown in the illustration. In the first method, a plug 1 in. in diameter is put in the machine spindle and is tested for running true. The work may be held either in the chuck or between the centers. A setting is made on the work with a height gage having an indicator attached, and the readings of both are noted.

For example: If the diameter of the work is 2 in. and the reading of the height gage is 4 in., the difference in height between the upper surface of the work and that of the plug is $\frac{2 \text{ in.} - 0.500 \text{ in.}}{2} = 0.750$ in. The height gage should then be lowered 0.750 in., reading 3.250 in., and applied to the plug. The knee is then raised or lowered until the indicator reads the same as before. An end mill in the spindle will then be at the center of the work.

In the second method, the same result can be obtained by using an inside micrometer set in a base and resting on the table, as indicated in the sketch. A third method (not illustrated) is to place a piece of thin paper on the work and raise the knee until the body of an end mill in the spindle touches the paper. Noting the difference between the diameter of the work and that of the end mill, the knee is raised one-half of that amount, bringing the end mill into the center of the work. I would prefer the third method to the one described by Mr. Budwitz.

Two simple methods of setting cylindrical work in the milling machine central with an end mill



Locating Helical Flutes

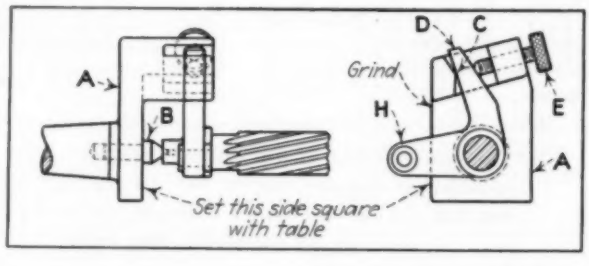
F. SERVER

Whenever it is necessary to locate helical flutes accurately in relation to a lug or a boss on the work, recourse must be had to some means of positioning the work in relation to the cutter.

One method of accomplishing this is to make a special holder for a center, as shown at *A*. The holder is mounted in the spindle of the index head in the usual manner and carries the hardened center *B*. It also has a lug *C*, against which the projecting arm *D* of the work is held by the screw *E*. This combination locates the work radially in relation to the center holder and insures that the hole in the arm *H* will be correctly positioned in regard to certain of the flutes, providing, of course, that the center holder has been set correctly. The holder is provided with a locating tang at the extreme left (not shown) to engage the dog slot in the driver of the index head.

Positioning the work radially in the holder is made relative to the side marked "Grind," therefore by squaring this side from the table of the machine, a correct setting will be established from which to start the cut. Thus, any number of pieces can be milled with the assurance that the flutes will bear the same relation to the center of the hole in the arm *H* of the work.

This fixture will locate the flutes in duplicate pieces in the same relative position



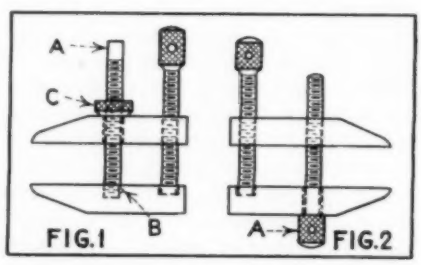
Improved Parallel Clamp

FRANK J. MAILE

For comparison, the improved clamp is shown in Fig. 1, while a clamp of conventional design is shown in Fig. 2. In an experience of twenty years as machinist and toolmaker, I have had more or less difficulty in using clamps of the conventional design, especially in restricted places. The trouble was that the head of the screw *A*, Fig. 2, would interfere with some part of the machine in which the clamped work was being operated upon.

In the improved clamp in Fig. 1, the screw *A* is reversed and passes through a clearance hole in the upper jaw. It is screwed into a blind, tapped hole in the lower jaw and is fastened by the pin *B*. Instead of this screw being revolved to close the jaws, the closing is done by screwing down the knurled nut *C*. This construction leaves nothing under the lower jaw to interfere with anything. The top of the screw is left unthreaded, so that the knurled nut can not be unscrewed from it and be lost.

I do not claim any credit for the improved clamp. I saw it in use in one of the shops where I was employed.



In the clamp in Fig. 1, the screw *A* is in the reverse position from that in Fig. 2, leaving no projection under the lower jaw

Laying-Out and Drilling Holes Accurately and Quickly

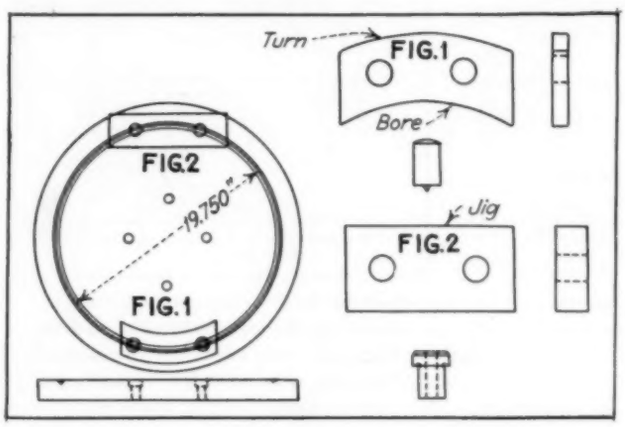
WILIAM C. BETZ

We had a quantity of pieces like that shown in Fig. 1 to be turned and bored in certain relation to the two drilled and reamed holes, the work to be within a tolerance of plus or minus 0.002 in. To do the work accurately and quickly it was necessary to make tools that would not be excessive in cost. Since we had no jig borer, we proceeded as follows:

The holes in the jig in Fig. 1 were accurately located and bored in the lathe, using buttons and an indicator. A pair of bushings that were a wringing fit in the holes were made, the holes in the bushings being for a tap-size drill. A spotting drill and two plugs having short 60-deg. center points were then made, the plugs being a very light push fit in the jig holes. Then the holding fixture shown at the left was made. It was carefully turned on a vertical boring mill and a V-groove having an included angle of 60 deg. was cut at a diameter of 19.750 in., using vernier trammels and a magnifying glass for testing.

A large bench plate was clamped to the table of a sensitive drill and parallels were placed on it and the holding fixture was laid on top of them. After pushing the center plugs into the holes in the jig with the center points downward, the whole was pushed toward the V-groove. When the points entered the groove (which could easily be felt with the fingers resting on top of the plugs), the jig was clamped in place. The center plugs were removed and the holes were spotted through the holes in the jig, these holes afterward being drilled to depth with a drill $\frac{1}{64}$ in. undersize and then reamed to size. The same procedure was followed until sixteen sets of holes were spotted, drilled and reamed around the holding fixture. On checking with a vernier, all holes were found to be within the limit of accuracy.

The holes for the screws for attaching the work to the holding fixture were next drilled and tapped, using the bushings in the jig for drilling. Bushing dowels were used for locating the work on the holding fixture. All the parts (Fig. 1) were drilled from the jig, which was made from non-deforming steel and hardened. The holding fixture was attached to the faceplate of the lathe by screws and was trued up by means of an indicator so that the V-groove and, incidentally, the holes ran true. Sixteen of the workpieces were attached around the holding fixture by screws and were turned and bored to size, bringing the holes central in relation to the turned and bored edges.



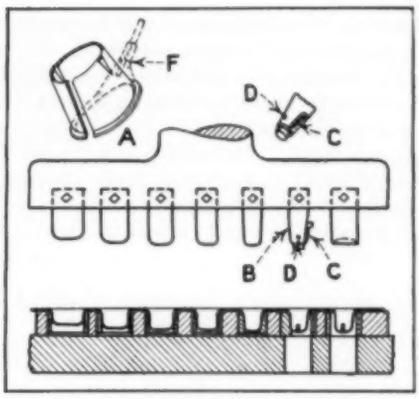
Method of attaching pieces to holding fixture for turning and boring in accurate relation to drilled and reamed holes

Press Tools for Making Split Sleeve-Connectors

NORMAN L. DERBY

In the illustration, the press tools for making split sleeve-connectors for automobile radios are shown in diagram, all unnecessary details being omitted for the sake of clearness. One of the completed connectors is shown at *A*, the side connection for the small wire being made in another operation.

The first five operations, beginning at the left, are ones of progressive drawing. For the first operation a rather heavily loaded pressure pad is used. A single pressure pad is employed for the remaining drawing operations, but it is more of the nature of a stripper. At first we had trouble from the stock splitting, but we are now using a special drawing brass and find that it works satisfactorily when lubricated with white lead and oil.



After the drawing operations, the punch B cuts out the closed end of the cup, splits the wall and forms two lugs. The flange is formed by the last punch

A lot of work is done by the punch *B*. It cuts out the closed end of the cup, slits the side wall by the cutter *C* and forms the two lugs at the bottom by the teats *D*. The last punch forms the flange at the top of the cup. In use, the completed sleeve is held by a clamp on one of the battery terminals and connects the radio with the battery.

An Improvised Index Plate

HECTOR J. CHAMBERLAND

An index plate of fair accuracy and quickly needed for experimental purposes was divided as follows: A slitting saw of the correct diameter and having the requisite number of teeth was clamped to the blank index plate, as

Slitting saw used to divide an index plate

shown in the illustration, a close-fitting bushing keeping the two concentric.

The locations for the holes were easily spotted with a small prick punch having a short point and held in the spaces of the saw teeth. After the index plate was drilled and had been tried out it was found to be accurate enough for the purpose for which it was wanted.

An Indicator for the Lathe

GEORGE J. MURDOCK
Murdock Research Laboratory

For boring holes in work located on the faceplate of the lathe, there have been many attempts to produce an indicator that would accurately show the correct location of the work from a prick-punch mark on its face in relation to the axis of the spindle.

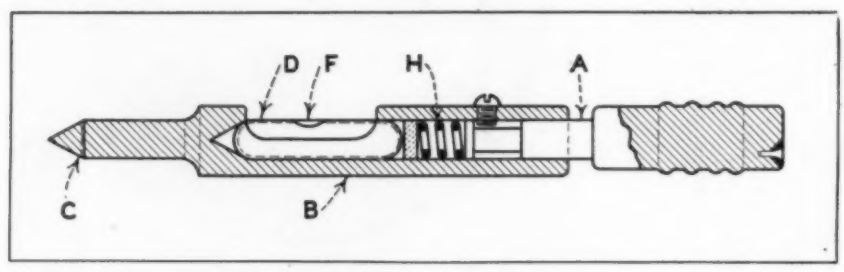
The indicator illustrated was designed to accomplish this purpose. Its object is not to show how much the work is out of center, but rather to show when it is accurately in center. Essentially, the indicator consists of the plunger *A* fitted to slide within the barrel *B*, and having an offset female center at its outer end; the barrel *B* having a male center at *C;* the sensitive spirit level *D*, the bubble of which can be seen at *F;* and the helical spring *H*, which compensates for the total length of the unit as the plunger is moved in the barrel.

In operation, the male center is placed in the prick-punch mark in the work, the outer end of the plunger being supported by the tailstock center engaging the offset center. The bubble is now likely to be found at one end of the glass. To bring it to the center of the glass it is necessary only to rotate the outer end of the plunger, thus raising or lowering the tailstock end of the indicator. The faceplate now being slowly rotated while the indicator is stationary, the bubble will move to one side or the other of the etched line on the glass.

When the bubble reaches the end of its movement toward the faceplate, if the work is lightly tapped on top with a hammer it will be seen by again rotating the faceplate that the amount of movement of the bubble is less than before. This method is continued, always tapping the top of the work, thus shortening the radius of the circle around which the male center travels, until the bubble appears to stand still as the faceplate is rotated.

For work that does not require to be located closer than 0.001 in., this is all that is necessary. Where great accuracy is required, the outer end of the plunger can be turned to bring the sharp edge of the bubble into coincidence with the etched line on the glass. If the faceplate is now rotated and the work is out so little as 0.0001 in., the edge of the bubble will move from the etched line. But if great caution is used in tapping the work, the coincidence will continue as the faceplate is rotated.

This method is so sensitive that it distinctly shows differences that would cause the pointer of a dial indicator only to tremble slightly and with no decisive movement. This sensitiveness is due to the absence of all joints, pivots or gearing, together with the lost motion that results from their use in most types of indicators.



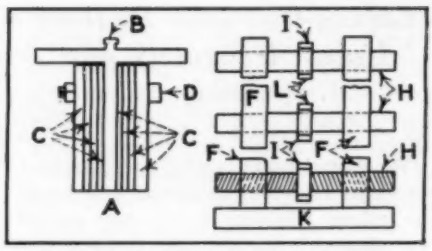
The sensitive level in this indicator indicates the position of the work in relation to the axis of the spindle

Tools for Forming Channels

C. B. DEAN

Perhaps the commonest metal shapes required for repairing locomotives and cars are channels of various sizes formed from sheet steel. They are used for patching and repairing sills and other parts in both the underframes and the superstructures.

An easy and efficient method of forming the channels is by use of the adjustable tools illustrated in connection with a press brake. The punch *A* is T-shaped and has a key at *B* for attaching it to the ram. The punch can be increased in width by attaching to the web as many plates *C* of various thicknesses as is necessary, the plates being secured to the web of the punch by bolts at *D*. The plates should be as long as are the channels to be formed, and wide enough to permit clear working space between the bolts *D*, a space not less than 5 in. being desirable.



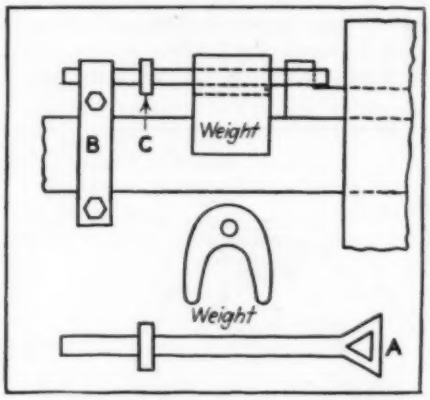
Channels for repairing locomotives and cars can be formed from sheet steel by these adjustable tools used in a press brake

The adjustable die consists of the two side bars *F;* the right- and left-hand screws *H* having hexagon-shaped centers at *I* for the application of a wrench; and the flat base *K*, which must be heavy enough to form an unyielding foundation. The inner edges at the tops of the bars *F* should be slightly rounded to facilitate bending. The working length of the die is the distance *L* between the hexagon parts of the screws, which must always be greater than the width of the punch and the length of the channel to be formed.

Tool for Removing Gib-Head Keys

S. LOMAS
Openshaw, Manchester, England

The simple device illustrated was made for removing gib-head keys without damaging the heads. The spade-handle end *A* is hooked over the head of the key, the shank being supported and guided by clips *B* attached to the shaft. The weight (about 20 lb.) slides freely on the tool shank, on which is the integral collar *C*. Sliding the weight quickly against the collar several times, giving heavy bumping blows, will remove the key, even if it has been driven in by a sledge hammer.



Gib-head keys can be removed by hooking the spade-handle end of the tool over the key head and bumping the weight against the collar several times

Isometric Projection of Circles—Discussion

FRANCIS W. SHAW
Heywood, Lancashire, England

In an article under the title given above (*AM*—Vol. 77, page 605), F. Trevor Daniel describes a method of laying out an isometric projection of a circle by using a 30-60-deg. triangle.

Referring to the accompanying illustrations, the outer ellipse in Fig. 1, described from the centers indicated, is intended by Mr. Daniel to represent an isometric circle. How far it falls short of perfection is revealed by the inner, correct, ellipse. That the inner ellipse is correct is shown by its representation of the described circle of an isometric square, indicated by the inner rhomb.

In practice there are two rather different problems to be met; one—the construction of the elipse on either axis; the other—the construction of the ellipse within, and to make contact with the sides of the isometric square. The first of these problems is a simple affair if a four-arc ellipse is permissible, all the construction being illustrated in Fig. 2. Whichever axis is given, the other is determined by drawing the line *A* with a 30-deg. triangle. The rest of the construction is obvious.

To construct an isometric circle in an isometric square, the procedure is indicated in Fig. 3. The problem is really that of determining the two axes, neither being known, and then constructing the ellipse by the method of Fig. 2. Determine the center of the isometric square (the rhomb) by drawing its diagonals. Draw *AOB* and describe upon it the circle *C*. Draw *OD* at 45 deg. to *AB*. Draw *EF* at right angles to *AB*. Then *OF* is equal to the semi-axis minor. Describe the circle *G* through the point *F* and the circle *H* through the point *D* of the intersection of *OD* with the rhomb. The diameters of these two circles define the major and minor axes. Points *K* and *L* on the circles are the centers of the elliptical curves. Lines *KM* containing the points *L* intersect *AB* at right angles. The points *M* are the points of joining of the curves.

One can naturally expect to find some defect in an ellipse approximated by circular arcs. The defect is here visible in the points of contact of the ellipse with the rhomb, instead of being at the mid points *N* of the sides, they are at the points *M*. However, this is not a serious matter.

The method of Fig. 2 is but a variation for the special case of the 30-deg. ellipse of that illustrated in Fig. 4, which for moderate differences in the axes produces an ellipse that, if superimposed upon an exact ellipse, shows hardly any discrepancy. All that need be said to explain the construction is that the line *A*, bisecting *BC* at right angles, intersects the axes at the points from which the circular arcs are struck, the points *D* being the points of joining of the curves.

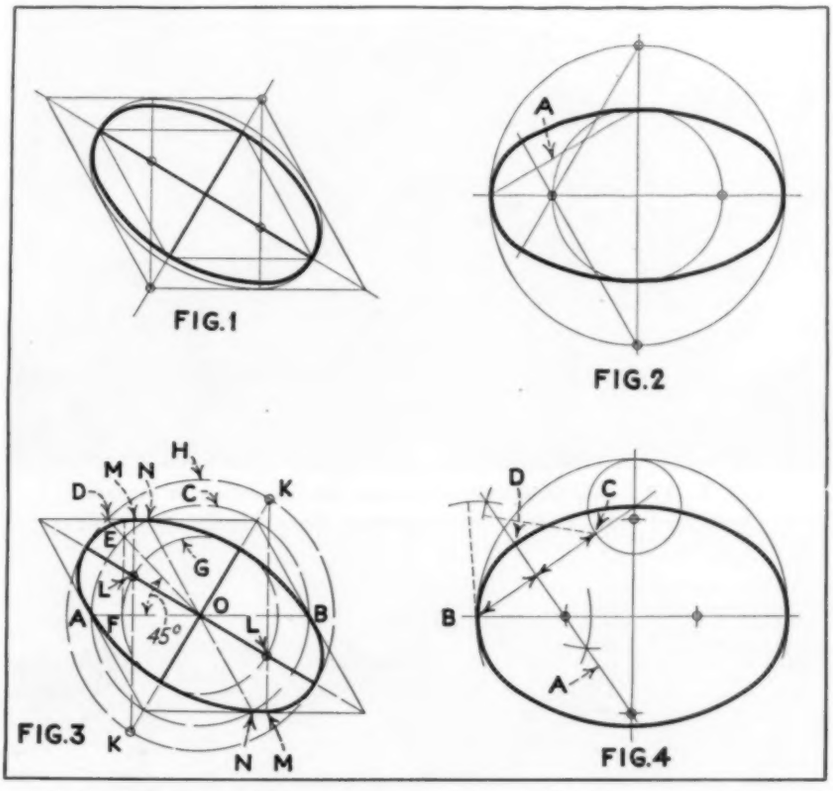


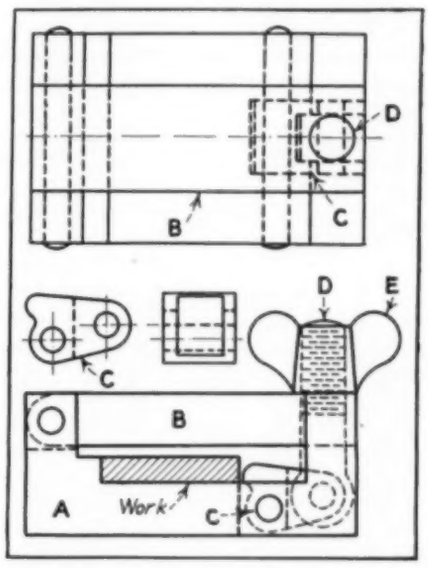
Fig. 1—The outer ellipse is described from the centers denoted. Its axes are in incorrect ratio. The inner ellipse is correct. Fig. 2—Construction for isometric circle, given either axis. Fig. 3—Construction for isometric circle in isometric square. Fig. 4—General method of constructing a four-arc ellipse

Jig for Locating and Locking Work Simultaneously

HAROLD E. MURPHEY

For drilling comparatively small parts that are finished to close dimensions, the jig illustrated is convenient and rapid in operation. It consists of the body *A;* the hinged cover *B*, which is also the bushing plate; the locking lever *C;* the locking stud *D;* and the wing nut *E*. The lower end of the locking stud is pivoted to the locking lever, which, in turn is pivoted to the jig body.

The work is located in a nest and is pushed against a ledge in the rear by the toe of the locking lever. When the wing nut is screwed down on the stud and contacts with the cover, further screwing raises the locking stud and pushes the toe of the locking lever against the work, forcing it back against the ledge at the rear of the nest. Thus, both the work and the cover are held tightly. By unscrewing the wing nut a turn or two, the locking stud can be swung down, releasing the work and the cover. The cover can then be raised for admitting or removing the work.



The work in the nest is pushed back against a ledge by the toe of the locking lever as the wing nut is screwed down on the stud

SHOP EQUIPMENT NEWS

Gridley Model R Automatic Screw Machines

Supplementing the 7/8-in. size (*AM*—Vol. 76 page 1108), the Model R, four-spindle automatic screw machine is now made in sizes to 2¼ in. by the National Acme Co., Cleveland, Ohio. This line is complemented by the Model GA four-spindle automatic which is built in sizes from 2⅝ to 3½ in.

The entire tooling section of the Model R machines is opened up so as to make each tool accessible for inspection or replacement. Furthermore, the tool is supported rigidly by heavier slides that in turn are supported by the massive bed casting. Cross-slides are supported on hardened steel ways and are completely gibbed. Spindles are equipped with anti-friction bearings throughout, permitting high spindle speeds for efficient use of carbide cutting materials. Productive capacity of the Model R is due in part to the rapid and smooth indexing of the spindle carrier.

The Model R is arranged to thread in the second or third positions, or both, and in all sizes. The same slide and operating mechanism, in either position, can be used for accelerated reaming or turning operations. The slide for each position is operated by a separate cam to give selective feed. To employ both forming tools and drills at the correct relative surface speeds for each tool, high-speed drilling attachments can be used in all four positions, and driven directly from the center gear mounted on the end of the spindle carrier stem. Only one drive is required from the gearbox to this center gear. An improved disappearing stock stop makes possible the use of standard tooling in the fourth position, and for many jobs this is the equivalent of an additional work spindle.

Besides the accessibility of the tooling, attention has been paid to the easy replacement of parts. The different mechanisms are easy to get at and to take apart. Cam drums, although mounted and guarded so that chips cannot clog them, are readily accessible so that cams can be changed without loss of time. Cams are easy to handle, giving assurance that the operator will change the cams to secure correct speeds for the job and thus increase production. An unusually large space is provided for chips which fall on a steel plate for quick draining. These chips can be removed from either end of the pan while the machine is operating.

Constant lubrication of all moving parts is taken care of by a pump located in a top section over the gearbox. Cutting oil is supplied by a separate pump. Low pressure flow is available for forming tools and high-pressure for drills.

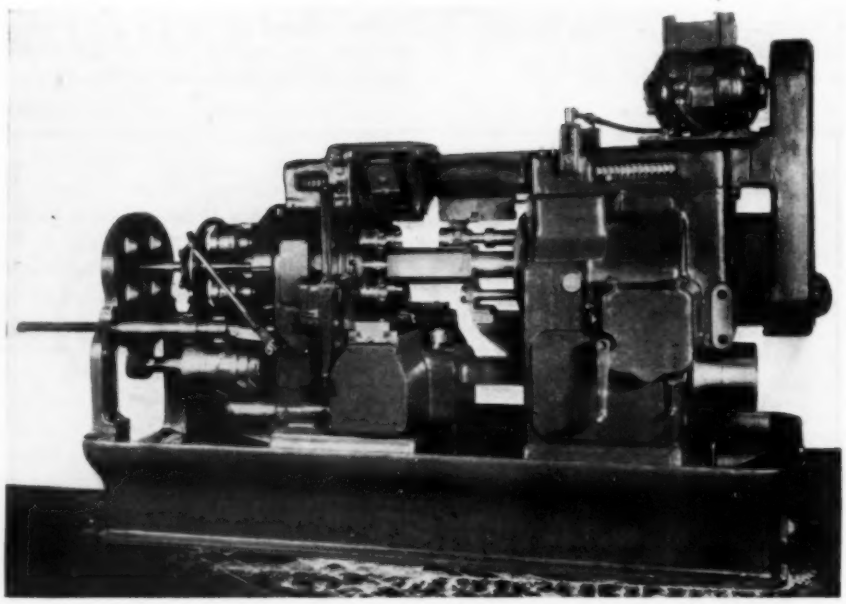


Fig. 1—Each tool is readily accessible for inspection or replacement and the various mechanisms are similarly accessible

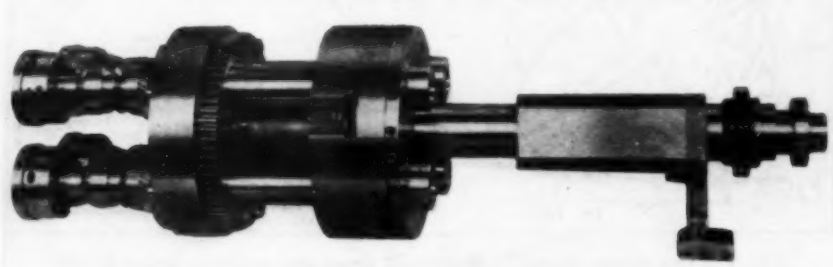


Fig. 2—Spindle carrier and main tool slide form a complete unit. The T-slots in the tool slide are ground parallel with spindles and spindle carrier stem to assure alignment of tool holder at any position in the slot

National Solid and Open-Die Cold Heading Machines

The National Machinery Co., Tiffin, Ohio, has announced a line of single- and double-stroke, both solid and open-die, cold headers in all sizes to 1 in. capacity. The bed frames are cast steel, and all bearings with the exception of the main shaft are of the roller type. The machines employ the company's over-arm heading slide that provides bearings for the slide, both at the front and rear of the crankshaft and enables the distance from the shaft to the front of the machine to be materially shortened. This construction reduces the spring or deflection in the bed frame and parts, and assists in making well-filled heads.

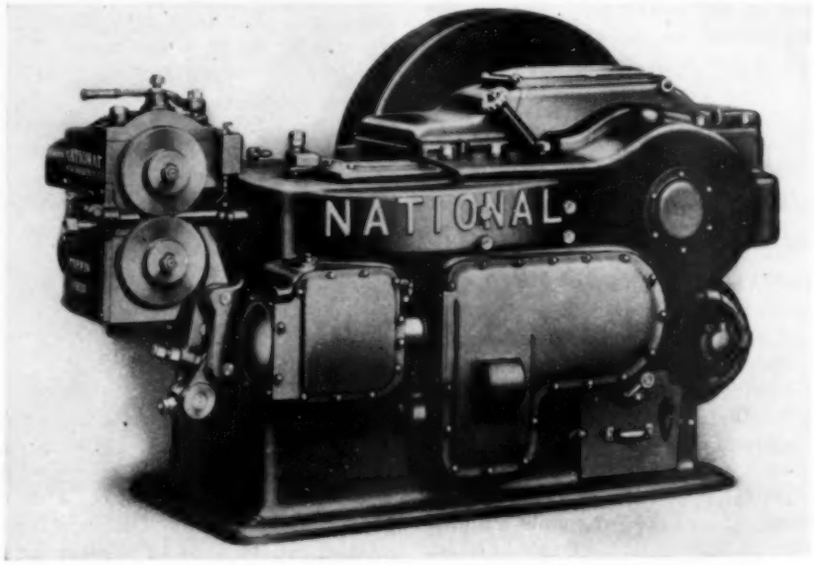


Fig. 1—National Cold Header available in single- and double-stroke, solid- and open-die models, in all sizes up to 1-in. capacity

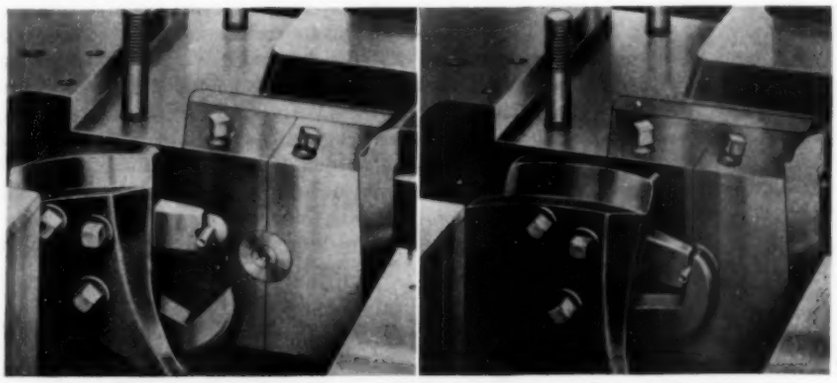


Fig. 2—Cut-off and carry-over mechanism which is held open at the time of feeding and does not scrape the wire on the return movement

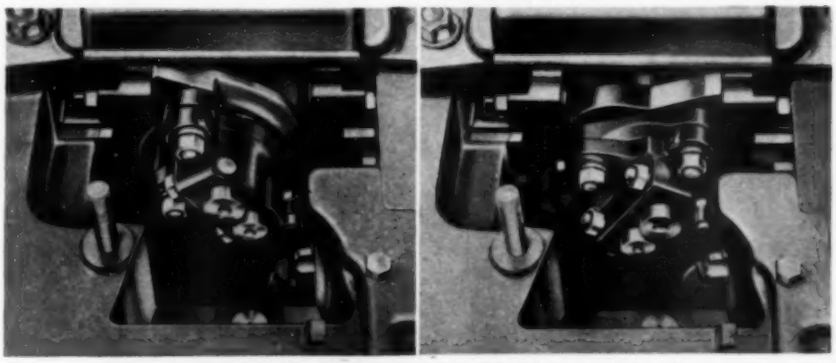


Fig. 3—Oscillating bolster on double-blow machine for transferring position of the coning and heading tools

The wire is fed to the machine at an angle in order to provide a more square end on the blank. An improved type of cut-off and carry-over is employed, as shown in Fig. 2. The carry-over mechanism holds the blank rigidly, but it is held open at the time of feeding and does not snap off from the blank on its return movement, so that there is no scraping of the wire. On the double-blow machine there is an improved mechanism for transferring the position of the coning and heading tools, as shown in Fig. 3. Tools are shifted from one position to the other by an oscillating bolster. Independent adjustments have been provided for both the coning and heading tools and facilities are provided for quickly changing or adjusting the dies or tools.

"Shield-Arc Eighty-Five" High-Tensile Electrode

Welds with tensile strengths of 85,000 to 100,000 lb. per sq.in. can be made with the arc welding electrode, "Shield-Arc Eighty-Five," according to the Lincoln Electric Co., Cleveland, Ohio. This electrode is designed for use on high-tensile steels. Ductility ranges from 15 to 20 per cent elongation in 2 in. The material is heavily coated and particularly suited for welding those low-alloy structural steels which on normalizing have tensile strengths to 100,000 lb. per sq.in. Examples are Cromansil, low-carbon nickel steels, structural silicon steels, low-carbon manganese steels, vanadium steels and all low alloy steels under 0.30 carbon. The electrode is suitable for flat, vertical and overhead welding and is available in $\frac{5}{32}$ and $\frac{1}{8}$ in. sizes.

General Electric Type W-22 General-Purpose Electrode

A general-purpose electrode of the heavily coated or shielded-arc type for producing welds required on Class I pressure vessels has been developed by the General Electric Co., Schenectady, N. Y. This electrode may be used in any position and has heat-penetrating properties. It is therefore equally suitable for butt and fillet welds.

Tests on all-weld-metal specimens made from Type W-22 electrode show

the following average results: Tensile strength, 65,000 to 75,000 lb. per sq.in.; Elongation, 20 to 30 per cent in 2 in., and impact resistance, 30 to 45 ft. lb. (Charpy). Welded joints average 35 to 60 per cent elongation when tested by the free-bend method and X-ray, Class I.

Link-Belt "V.R.D. Variable-Speed Transmission

A self-adjusting, positive, variable-speed transmission for fractional horsepower duty, known as the "V.R.D." (variable roller drive), is being announced by the Link-Belt Co., Philadelphia, and Chicago. The equipment is a companion to the "P.I.V. Gear" variable-speed transmission which has been built for some time in larger capacities.

The unit, which is capable of an output of ½ hp. at maximum speed, with

a maximum ratio of speed variation of 10 to 1, has such features as all-metal construction, total inclosure, self-lubrication, and the use of a chain for transmitting power. The chain is a side-contact roller type consisting of steel links made endless and connected by hardened steel pins in hardened steel joint bushings.

Openings in each pitch of the links provide a pocket for each of two hardened steel rollers. From both sides of the pockets a portion of the roller protrudes. Each pair of chain rollers, at each engagement of chain and wheels, rolls into contact with hardened-steel conical opposed disks forming the driver and driven wheels. The chain is engaged positively in the wedge-shaped wheels at the proper pitch line for the speed desired on the output shaft. A speed indicator is provided.

Acme Type L-8 Two-Wheel Polishing and Buffing Machine

The Acme Manufacturing Co., 1645 Howard St., Detroit, Mich., has designed a two-wheel polishing and buffing machine to perform two operations at one loading of the work. Both wheels may contact with the same surface for the purpose of cutting down and coloring, or two different surfaces can be polished. An indexing head, eight work holders and two polishing units comprise the machine. The wheel units are adjustable so that contact with the work may be obtained at any desired angle. Indexing is accomplished automatically at the rate of 250 to 1,200 times per hr. Spindles opposite the buffing wheels revolve, while the three lower spindles remain stationary for loading. Work is automatically ejected during indexing when the part reaches a point midway between the right-hand revolving station and the next lower station. Parts up to 4½ in. in diameter may be handled.

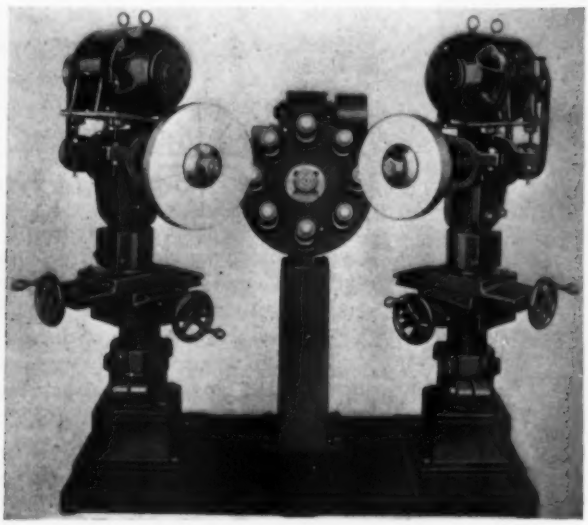
Thomson-Gibb Production Seam Welder

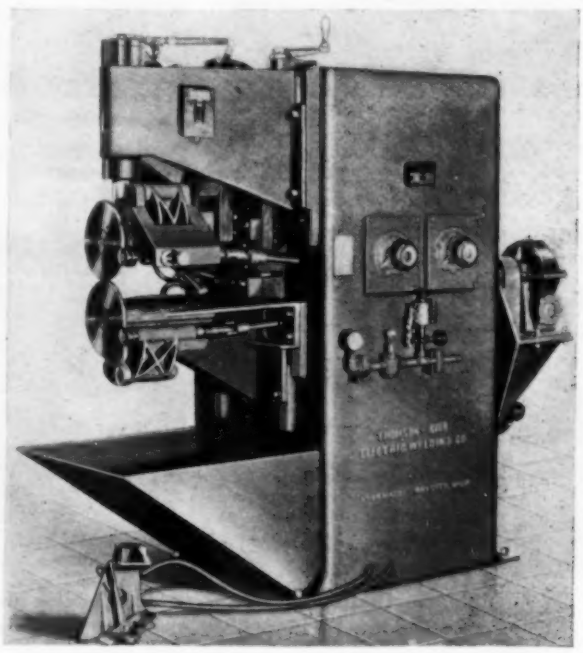
A "1000 Series" seam welder has been developed by the Thomson-Gibb Electric Welding Co., Bay City, Mich., for production of straight or circular seam welds in ferrous metals, corrosion-resistant steels and, with slight modifications, in non-ferrous metals. The welder will handle work from 10½ in. in diameter by 12 in. in length to 40 in. in diameter by 45 in. in length, and at welding speeds varying from 2 to 15 ft. per min., and with welding pressures from 650 to 1,400 lb. Transformer capacities range from 100 to 250 kva., depending upon the work. Knurl or friction drives provide constant welding speed.

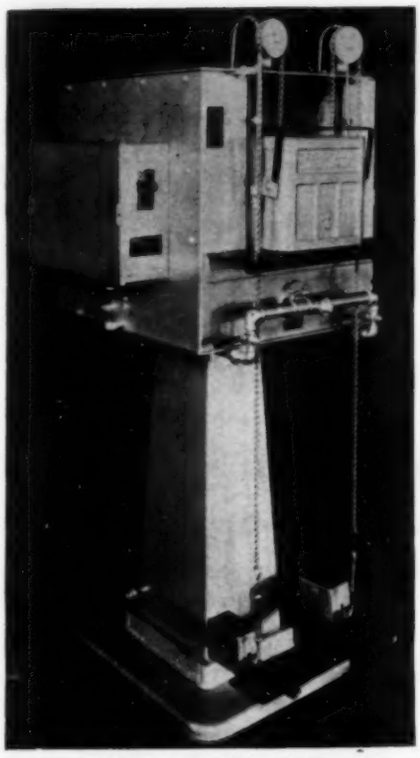
Sentry Model "W" Electric Furnace

Two methods of maintaining proper furnace atmosphere can be used with the Model "W" electric furnace developed by the Sentry Co., Foxboro, Mass. The company's "Diamond Block" method can be used to produce an atmosphere containing in excess of 25 per cent carbon monoxide for the purpose of hardening small tools. A licensed gas curtain is also available to harden various tool steels at temperatures of 1,400 to 1,800 deg. F., particularly when tools are too large to be accommodated in the "Diamond Blocks." This gas curtain can be operated to give an atmosphere containing approximately 12 per cent carbon monoxide, which is suitable for many tool steels.

Treadle operation is furnished for the







Sentry Model "W" Electric Furnace for hardening steel

door. Automatic temperature control is customarily supplied to maintain the furnace temperature at plus or minus 10 deg. F. of setting, when operating at any temperature between 1,000 and 2,600 deg. F. The furnace will heat from cold to 2,350 deg. F. in 1¾ hrs. Size No. 1 has a heating chamber 4½ in. wide by 4 in. high by 12 in. deep. Rating is 16 kw. on 220-volt a.c. circuits.

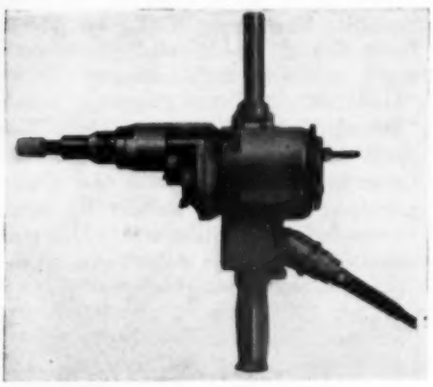
Monitor Pushbuttons

The Monitor Controller Co., Baltimore, Md., offers a Type 9000V pushbutton, illustrated, for machine tool applications and general purpose use. The stop button is in a conspicuous position for quick accessibility, while the start button is in a protected place to prevent accidental pressure. The conduit entrance may be turned to top, bottom or either side, but the contacts are always set for operation with the stop button at the top. This type of station is available in single-, two- or three-button types and in a variety of contact arrangements.

A Type 9000M oil-immersed pushbutton station is also built for corrosive or damp atmospheres.

Buckeye High-Frequency Nut Runner

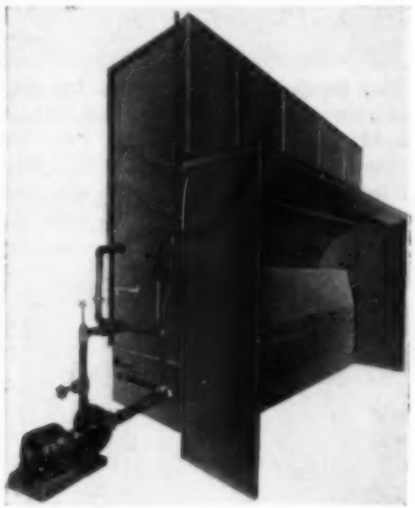
A high-frequency, electric nut runner with an adjustable releasing clutch that tightens the nut without shock to the operator is being introduced by The Buckeye Portable Tool Co., Dayton, Ohio. An adjustable releasing cam trips open the clutch when the nut is tight.



The tool is made in a number of sizes. Specifications for the No. 30-N, illustrated, are: 3 phase, 180 cycles, 225 volts; speed, 750 r.p.m.; capacity, ⅞-in. and light ⅜-in. nuts; length, 14 in. weight, 16½ lb.

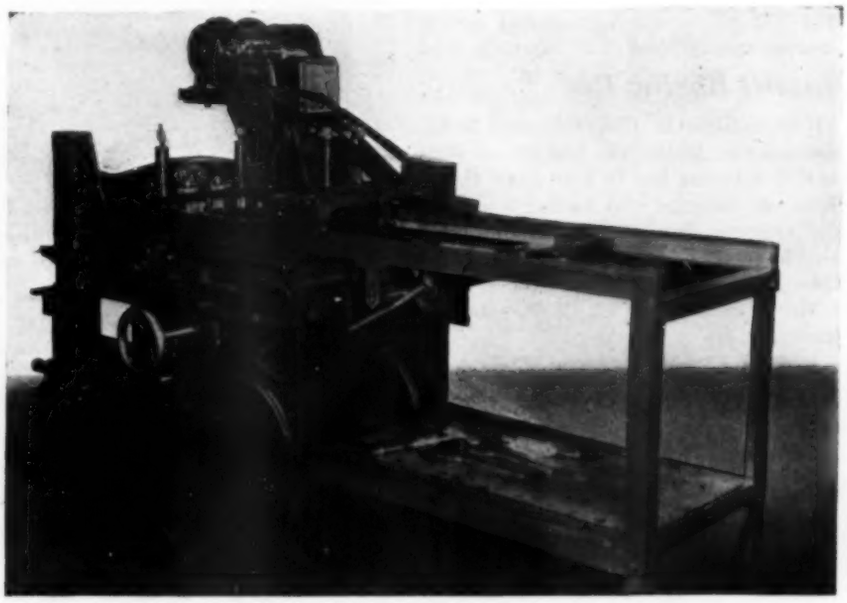
DeVilbiss Water Booths

For prevention of the discharge of heavy, solid, sticky paint residues to the outside of buildings, a line of water booths has been developed by the DeVilbiss Co., Toledo, Ohio. These booths may be operated in neighborhoods where the use of standard fan or blower type booths would be prohibited. The exhaust piping is easily located to suit particular conditions. "Opposed direction" sprays secure separation of solids.



Brown Automatic Blanking Shear

R. H. Brown & Co., New Haven, Conn., has developed a line of automatic metal blanking shears to take sheets from 0.010 to 0.162 in. thick, from 4 to 36 in. wide and up to 25 ft. long. The blanks cut by these machines range from ⅛ to 36 in. wide.

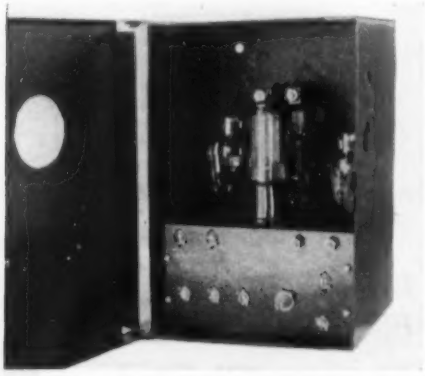


Brown Automatic Blanking Shear having a speed of 110 blanks per minute

The machine illustrated holds as many as 225 sheets of 0.025 in. stock at one time. The only hand operation required is loading the magazine. For narrow blanks there is an attachment which stacks the blanks as they are cut. The carriage is a steel casting and rolls on precision ball bearings. Drive is furnished by a 1-hp. ball-bearing, geared-head motor with V-belt drive.

Westinghouse Type "LE" Photo-Electric Relay

A much lower-priced photo-electric relay for general industrial use has been announced by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. The heavy-duty contactor in this "LE" relay interrupts 20 amp., 115 volts, a.c., non-inductive load, or 3 amp., 115 volts, d.c.



In such applications as counting the operating speed is fast, ranging from 200 to 600 objects per minute and depending upon the amount of light change available and the resistance of the contacts. Gas or vacuum phototubes can be used.

Russell Boring Bar

Roy V. Russell, 1207 Calumet Ave., Middletown, Ohio, has placed on the market a boring bar to bore from 9/16 to 12 in. in diameter and having micrometer adjustments. Shanks for this tool may be made up in Nos. 9, 10, 11 or 12 Brown & Sharpe tapers or Nos. 4, 5 or 6 Morse tapers, and all shanks are interchangeable.

Fig. 1—Russell Boring Bar for bores from 9/16 to 12 in. in diameter

The tool utilizes three interchangeable boring bars that slide and clamp in the T-slot of the main head. These bars are as follows: ½ in. bar to bore a length of 4 in.; ¾ in. bar to bore 5½ in., and 1¼ in. bar to bore 7 in. The maximum adjustment is such as to permit boring a 12-in. diameter hole in all cases with the axis of the boring bar parallel to the axis of the shank. With the axis of the bar at right angles to the axis of the shank any reasonable diameter can be bored.

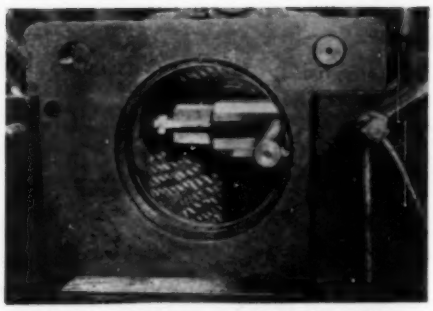


Fig. 2—Boring a 9-in. hole, using a 1¼-in. bar

"Airco" Pantograph-Type Gas Cutting Machines

The Air Reduction Sales Co., 60 East 42nd St., New York, N. Y., has added to its line of pantograph-type gas cutting machines the following units: "Airco-DB" No. 7 "Oxygraph" and "Airco-DB" No. 1 "Travograph." The No. 7 Oxygraph has no tracer bar, the tracer being attached to the end of one pantograph arm and the cutting torch to the end of the other arm. This machine is designed for single-torch operation only. The tracing table for holding the full-scale drawing is part of the machine and is located on top of the bed, between the vertical posts. Either a manually controlled or a magnetic tracer can be used.

In the pantograph construction the fourth side of the parallelogram is removed at the rear. This arrangement allows the working ends of the arms to swing between the vertical posts that

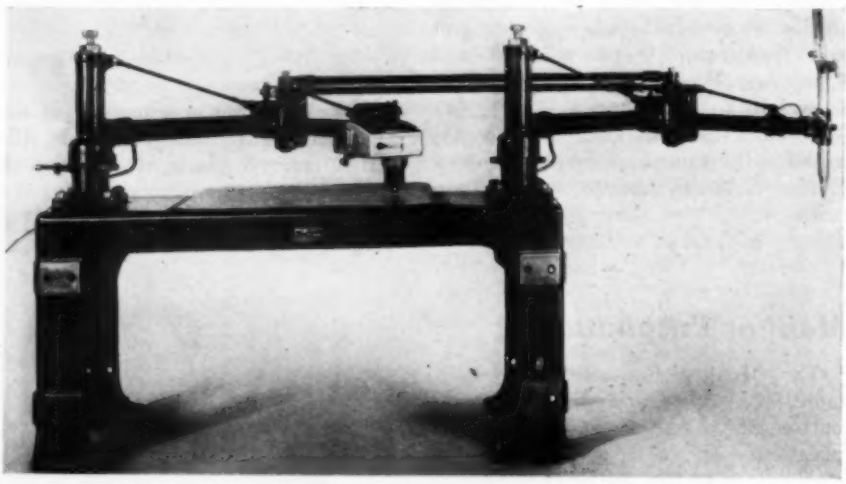


Fig. 1—"Airco-DB" No. 7 "Oxygraph" arranged to permit the arms to swing between the vertical posts, as well as in back of them, to cover a greater cutting area

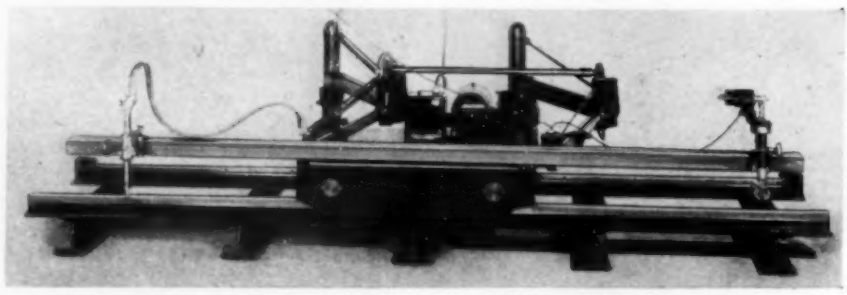


Fig. 2—"Airco-DB" No. 1 "Travograph" in which the pantograph assembly is mounted on rails for extended cutting area

support the pantograph assembly, as well as in back of them and thus permits the covering of a maximum cutting area with a given length of arms.

In the case of the No. 1 Travograph, the pantograph assembly is mounted on a carrier that travels on rails to extend the cutting area. Similar to the No. 6 Oxygraph the No. 1 Travograph is fitted with a long tracer bar attached to the outer ends of the pantograph arms. The tracer mechanism and cutting-torch holders are mounted on this bar and may be moved to any position along the bar and secured in place. As many as six cutting torches may be mounted for multiple cutting. The No. 1 Travograph can also be operated with either manually controlled or a magnetic tracer. The rails on which the carrier runs are 16 ft. long.

The cutting area or range of the No. 7 Oxygraph is a 30 in. square or a 36 in. diameter circle, while that of the No. 1 Travograph is a rectangle 4½ ft. in width and 11 ft. in length with one 16-ft. section, or any length desired with additional rail sections.

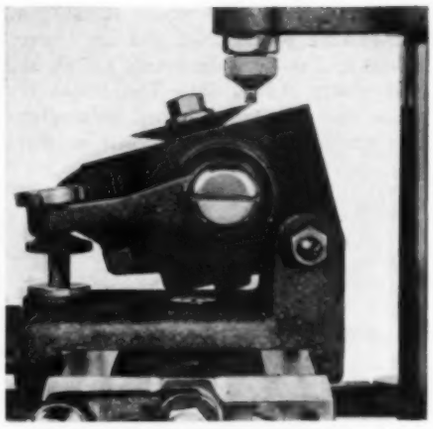


Fig. 2—A rectangular specimen is used with this fixture

"Maximeter" and "Maxipoint"— Instrument and System for Heat-Treatment Control

Because of dissatisfaction with the casual manner employed for specifying draw temperature, the Greenlee Bros. & Co., Rockford, Ill., have developed the "Maximeter," an instrument, and "Maxipoint," its objective, a system of heat-treatment control and specification. The spread in drawing temperatures that is recommended for all except high-speed steels is 470 deg. (280 to 750 deg. F.). Therefore, this system of heat-treatment control and specification was developed upon the assumption that there is a complete and thorough uniform hardness for each steel, and that the ideal draw temperature will leave a structure in which the hardness is just beginning to give way to ductility. The temperature of the draw, which leaves this dual condition, is known as the "Maxipoint" of the steel. The Maximeter system is used jointly with hardness testers and correlative hardness numbers are necessary for best results.

The Maximeter stands about 30 in. high. It has a fixture for holding the test piece, and a plunger and a cylinder that contains a set of graduated weights. These weights range from one to eight ounces. The specimen is usually of circular form and is turned with one surface flat and the other side having the edge beveled at a 21 deg. angle. The specimen is presented to the impact plunger at a 15 deg. angle. Fig. 2 shows the instrument carrying a rectangular specimen.

The specimen is first given a complete hardening, then placed in the instrument and given an impact by the No. 8 and No. 1 weights, both of which should fracture the specimen and cause pieces to fly from its edge. This is to insure the presence of hardness. If the steel is of an unknown analysis, it should be drawn to 300 deg. F. and held at that temperature for 30 min. It is then placed upon the anvil and the No. 8 and No. 1 weights permitted to fall. This test will usually indicate that there is complete hardness in this specimen and both weights will cause fracture. The specimen should then be drawn to 400 deg. F. and a like test made. If again both weights cause fracture, the specimen should be drawn 600 deg. F. If both weights fail to break out pieces from the specimen, there is evidence that the 600 deg. F. draw has passed the specimen into a condition of ductility rather than hardness. Another specimen should then be drawn to 550 deg. F., and given the full series of impacts, Nos. 8 to 1 inclusive. This test will probably show brittleness and pieces will fly out of the specimen. Another draw at 575 deg. is taken and the four heavier weights will fracture the edge and the four lighter weights will cause only indentations. Then, according to the theory of the instrument, the "Maxipoint" has been reached. Should but two cause indentations and six cause fractures, the test is an indication that about 10 deg. more temperature should be given the specimen.

Fig. 1—When four weights fracture the edge of the specimen, and four do not, the draw temperature concerned has achieved the maximum hardness

Bantam Nos. 201 and 203 Shielded Radial Bearings

Offered for use in generators, small high-speed tools, grinders, motors, pumps and speed reducers, the No. 201 and No. 203 ball bearings are manufactured to S.A.E. standard limits by the Bantam Ball Bearing Co., South Bend, Ind. The bore of the No. 201 is 0.4724 in., and the outside diameter

1.2598 in., and the width 0.3937 in. Dimensions of the No. 203 are: bore, 0.6693 in., outside diameter, 1.5748 in., and width, 0.4724 in. The shield retains the lubricant almost indefinitely and prevents entrance of dust or dirt.

• PATENTS •

APRIL 17, 1934.

Metal-Working Machinery

Screw Thread Gage. Robert Thomson, Arlington, N. J., assigned to Dardelet Threadlock Corp. Patent 1,954,852.

Machine for Centering and Marking Crank Shaft Forgings. Mark H. Damerell, Worcester, Mass., assigned to Wyman-Gordon Co. Patent 1,954,920.

Device for Feeding Bar Stock to Machine Tools. Karl Tessky, Esslingen-on-the-Neckar, Germany. Patent 1,954,964.

Double Stroke Cold Header. John H. Friedman, Tiffin, Ohio, assigned to the National Machinery Co. Patent 1,955,061.

Means for Finishing Gears by Lapping. Edward W. Miller, Springfield, Vt., assigned to the Fellows Gear Shaper Co. Patent 1,955,082.

Lathe. Eric C. Biewend, Walter R. Konkle, and Harry L. Konkle, Albion, Mich. Patent 1,955,220.

Metal Working Machine. Edward A. Conner, Stratford and Harry G. Robinson, Waterbury, Conn., assigned to American Chain Co., Inc. Patent 1,955,535.

Tools and Attachments

Lathe Tool. John M. Christman, Detroit, Mich., assigned to Packard Motor Car Co. Patent 1,955,357.

Lapping Tool. Carl W. Floss, Detroit, Mich. Patent 1,955,362.

Thread Cutting Chaser. Albert F. Brientenstein, New Haven, Conn., assigned to the Geometric Tool Co. Patent 1,955,530.

Collet. Guy Laughlin, Birmingham, Mich. Patent 1,955,642.

APRIL 24, 1934.

Metal-Working Machinery

Crank Shaft Grinder. George Herzog. Great Falls, Mont. Patent 1,956,068.

Machine Tool. Fernand Turrettini, Cologny, Switzerland, assigned to Societe Genevoise d'Instruments de Physique, Geneva, Switzerland. Patent 1,956,110.

Electric Arm Clamping and Elevating Mechanism. Augustus M. Sosa, Cincinnati, Ohio, assigned to the Cincinnati Bickford Tool Co. Patent 1,956,540.

Tools and Attachments

Back-Lash Compensator. Leo A. Dumser, Rockford, Ill., assigned to Sundstrand Machine Tool Co. Patent 1,955,954.

Tool Holder. Nicholas Gron, Chicago, Ill. Patent 1,956,023.

Tipped Tool and Working Implement. Richard Braun, Stuttgart, Germany, assigned to Fried. Krupp Aktiengesellschaft, Essen-on-the-Ruhr, Germany. Patent 1,956,233.

Gage. Clinton V. Johnson, Hartford, Conn., assigned to Pratt & Whitney Co. Patent 1,956,292.

• TRADE • PUBLICATIONS

BALL BEARINGS. Form A-31 on conveyor roller bearings and Form A-36 on mine car bearings are two bulletins available from the New Departure Manufacturing Co., Bristol, Conn. Bearings in both types are self-inclosed, sealed and lubricated.

BERYLLIUM COPPER. The properties and applications of beryllium copper are discussed in a booklet under that title issued by the Riverside Metal Co., Riverside, Burlington County, N. J.

CHAINS. Catalog V-115 issued by the Whitney Mfg. Co., Hartford, Conn., is a complete engineering manual on the company's roller chains and sprockets. The booklet contains 52, 8½ in.x 11-in. pages, showing roller chains in actual size, specifications, special attachments, installation, engineering data on design, tables of horsepower ratings, roller chain lengths, sprocket diameters and chain casings.

CONVEYING AND TRANSMISSION EQUIPMENT. A catalog of 1,025 pages with list prices, effective April 1, has been published by the Link Belt Co., Chicago, Philadelphia and San Francisco. The book contains information on the mechanical conveying and preparation of materials, and the transmission of power.

DIEHEADS. General-purpose "H&G," self-opening dieheads are fully described, and methods of installation on various machines are shown in a bulletin available from the Eastern Machine Screw Corp., New Haven, Conn.

DRILLING MACHINES. Sensitive 16-in. ball bearing drilling machines with V-belt drive are shown in Bulletin No. 2730-B issued by the Buffalo Forge Company, Buffalo, N. Y.

EMPLOYEE REPRESENTATION PLANS. A report made by the Committee on Industrial Relations of the National Metal Trades Association on the history and types of representation plans and their respective advantages and disadvantages. Copies may be secured from the Association office, 122 South Michigan Ave., Chicago, for 25 cents.

HEATING ELEMENTS. The Harold E. Trent Co., 618 N. 54th St., at Poplar, Philadelphia, Pa., has issued a folder showing electric heating elements and units, describing its strip heaters, their applications and temperature range, ratings and listing prices. Immersion units are shown in a separate leaflet.

PHOSPHOR BRONZE. A pamphlet giving the characteristics and applications of phosphor bronze and of nickel silver, both in free cutting varieties, is issued by the Riverside Metal Co., Riverside, Burlington County, N. J.

ROLLER BEARINGS. The "Timken Engineering Journal" is a 266-page loose-leaf book of general information on the various types of bearings made by The Timken Roller Bearing Co., Canton, Ohio. The book differs from previous editions, since new low ratings have been established, conforming to the fatigue life of the bearings. This information is followed by a statistical presentation of the bearings available in the various types. These tables have been arranged uniformly by cone bore. Following these tabulations are the T-types or flat thrust bearings and the stearing-gear type bearings. Approximately 200 pages comprise the Dimension Sheet Section. The illustrations in this division are to scale and accurate to 0.01 in., and thus the draftsman can trace the bearing in the proper position on his drawing either full or half size, as both sizes are given. Shaft and housing design, typical mountings of single, double and quadruple assemblies, closures, fitting tolerances for both cups and cones, assembly methods, data on lubrication and a description of the wear and lubricant tester concludes the book.

SLIDE RULES. Construction of special slide rules is discussed in a bulletin known as Extension Series No. 32 and entitled "Special Slide Rules" by J. N. Arnold. The bulletin is published by the Purdue University, Lafayette, Ind.

STEEL. "C.Y.W. Choice Steel" is described in a circular issued by the Firth-Sterling Steel Co., McKeesport, Pa. The circular lists typical analyses, uses, heat-treatment, forging and other treatments.

WELDING RODS. The American Brass Co., Waterbury, Conn., has available Publication B-13 on "Anaconda" welding rods for gas and electric welding. Information is given on fourteen different welding rods and on the methods of welding.